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The Umbrascope

A Simple Instrument for the Determination of Surface Irregularities of Transparent, Light Wall, Glass Containers

By C. D. Spencer* and A. E. Badger*

Every manufacturer of glassware submits his product to various forms of inspection. Examination is made for the presence of strain, heavy cords, seeds or bubbles, and inclusions of foreign material, such as devitrification crystals, clay stones, batch stones, etc. Other defects being eliminated the appearance of the finished article will in a large measure depend on the condition of the surface of the glass, i.e., whether the surface is smooth and free from irregularities. The usual method of examining for the general appearance of transparent glassware is to hold the article before a uniformly illuminated screen and view by transmitted light. Both ruled and unruled screens are in use. This method of examination is not sensitive enough to make visible the slight ruffling of the surface of blown and pressed glassware introduced by contact with the mold.

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An article such as a paste mold flask will show practically no evidence of these surface marks when held before a uniformly illuminated screen. Under these conditions deep corrugations in the surface will appear as variations in the intensity of the light transmitted to the eye, but the difference will not produce enough contrast to be especially noticeable. The ruled screen does not facilitate matters in this respect, for deep surface irregularities cause but a slight displacement of the ruled lines as observed through the glass object. In fact these surface markings are much more evident when the article is viewed in the half-shade effect produced by a window illuminated by daylight. In the majority of cases slight irregularities in the surface of blown and pressed hollow-ware do not prove deleterious. In some instances, however, they constitute a serious defect, and the purpose of this article is to describe a simple method by means of which the condition of the surface may be made evident to the eye.

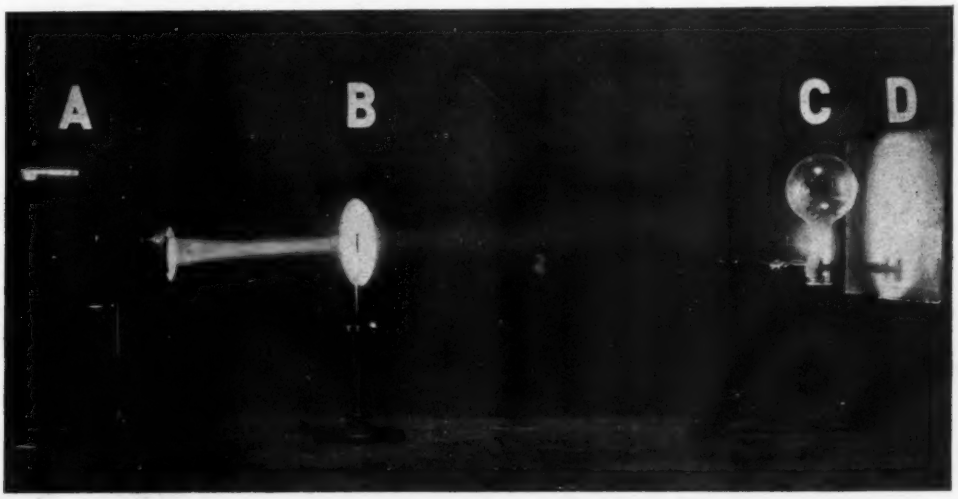


FIG. 1

In its simplest form the method is illustrated in Figure 1. "A" is an illuminator consisting of a concentrated filament lamp and a simple lens by which an image of the filament is focussed on the vertical slit in the screen B. The article to be examined, C, is placed a short distance before the ground glass screen, D. The photographs accompanying this article were taken with a set-up such as described above in which the distances were as follows:

A B = 2 feet; B D = 10 feet.

The width of the slit in this instance was 1/16 inch.

Another form of this apparatus consists of an ordinary projection lantern, the lens system of which is adjusted to throw a divergent beam of light on the ground glass screen.

As mentioned above the usual method of examination for the appearance of a transparent glass article consists in placing the object between the eye and the illuminated screen. In the method herein described the positions of the object and the ground glass are interchanged. In this reversed order irregularities in the surface of the object act as convergent or divergent lenses, concentrating or dispersing the rays of light as they pass through the glass, and appear on the ground glass as bright or dark spots or bands. This apparatus will be referred to hereafter as the "umbrascope," since the surface irregularities of the object appear as shadow-like images on the screen.

In order to demonstrate the superiority of the umbrascope

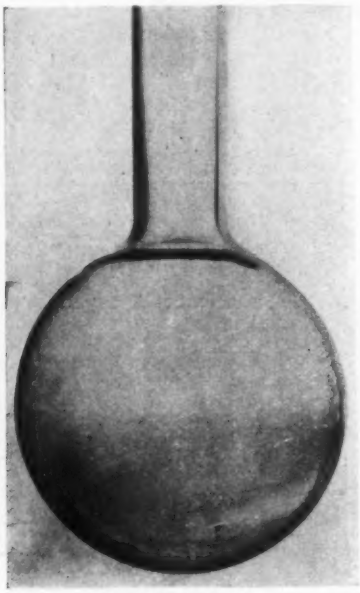


FIG. 2 (a)

FIG. 2 (b)

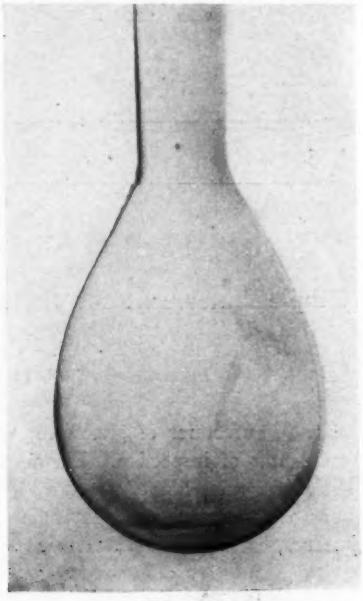


FIG. 3 (a)

FIG. 3 (b)

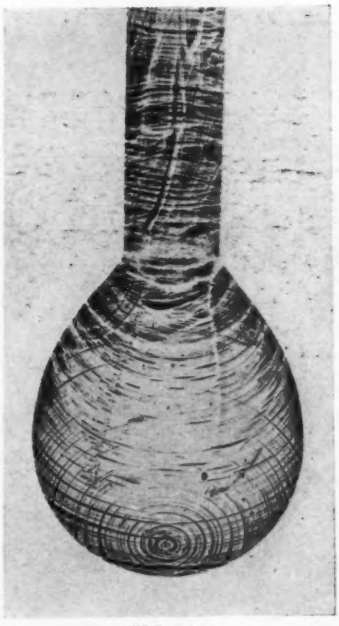


FIG. 3 (c)

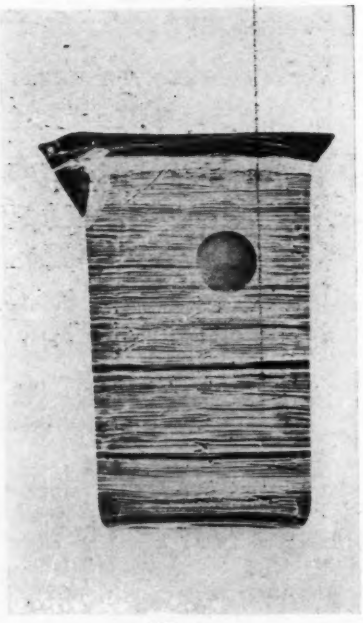


FIG. 4

over other methods for detecting surface irregularities, a series of photographs of representative articles has been taken as viewed under the two conditions described above.

Figure 2(a) shows the appearance by transmitted light of an ordinary boiling flask placed before a uniformly illumi-

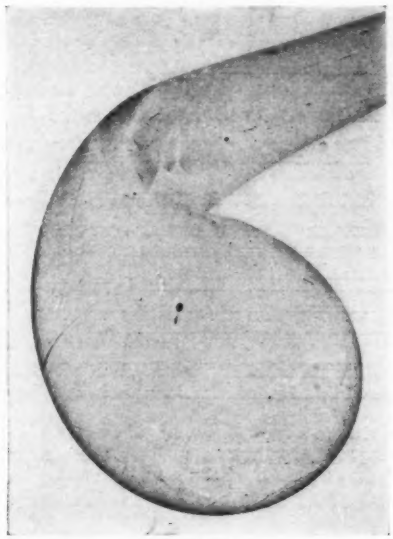


FIG. 5

nated ground glass screen. Figure 2(b) is a photograph of the same flask as it appears on the screen of the umbrascope. Figure 3(a) is a Kjeldahl flask as it appears before a ground glass screen. Figure 3(b) shows the effect observed on the screen of the umbrascope. In figure 3(c) the flask has been tipped in the line of sight to show the con-

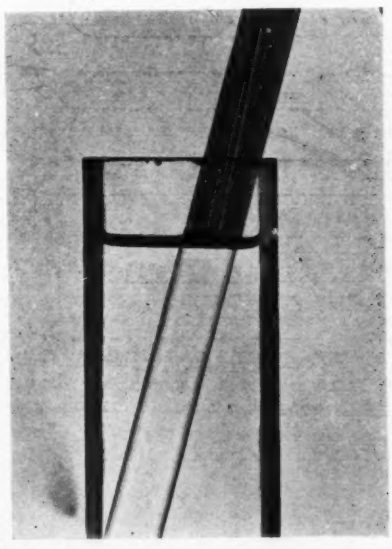


FIG. 6

centric markings. These rings are impressed on the plastic glass as it rotates against the mold. Figure 4 is an ordinary hard glass beaker.

Figure 5 is a thin-walled retort as it appears in the field of the umbrascope. This retort was blown without a mold and its appearance is characteristic of "off hand" pieces.

It is apparent from these photographs that the markings on the glass are caused by irregularities in the surface of the paste mold against which the glass is blown and rotated, or to the crizzling effect resulting from rapid cooling in the case of pressed ware.

If it is desired to distinguish the markings on the interior and exterior of a piece of hollow-ware, the surface not under consideration may be rendered optically inactive by covering with a liquid of the same refractive index. Thus, to examine the exterior surface, the article may be filled with the proper liquid, while to examine the interior surface it may be immersed in a small tank having plane parallel windows.

Figure 6 demonstrates the fact that the effect observed on the screen of the umbrascope is produced mainly by irregularities in the surface, and not by optical inhomogeneities (striæ) existing in the glass. This is a photograph of a piece of tubing, half of which is immersed in a liquid of refractive index approximately equal to that of the glass. Both the interior and exterior surfaces are thus rendered optically inactive. A convenient immersion liquid for ordinary lead and lime glasses is monochlorobenzene. ($N_D = 1.52$). The index of this liquid may be raised by the addition of small quantities of monobromonapthalin or lowered by means of carbon tetrachloride.

The photographs showing the effect produced on the screen of the umbrascope were made without the use of a camera lens system by substituting a photographic plate for the ground glass screen. Figures 2(a) and 3(a) were taken with an ordinary camera lens.

The umbrascope should prove useful for investigating the relations existing between the different methods of fabrication and the condition of the surface of the finished product. By this means it is possible to study the effects produced upon the surface of blown and pressed ware by changes in the viscosity of the glass, the nature of the surface against which the blank is shaped, the force exerted during shaping, and other factors. It will be noted that complicated apparatus is not required and that a permanent record of observations may be obtained by the substitution of a photographic film or plate for the ground glass screen.

The Ideal Glass Sand

An ideal glass sand should be of uniform size of grain and preferably angular or sub-angular rather than rounded. This ideal sand should all pass a 40 mesh sieve and all be retained by a 60 mesh sieve.

In practice, no commercial sand fulfills these conditions. A screen analysis of any standard sand, such as Ottawa or Berkeley, would show a few coarse particles retained by a 20 mesh screen, about 50 per cent in the case of Ottawa and 20 per cent in the case of Berkeley being held by the 40 mesh screen, and the bulk of the remainder staying on the 60 mesh, with decreasingly smaller amounts carried through some even to 200 mesh.—*Irving E. Adams.*

Fire Loss Record for U. S. Glass Works

Year	Claim	Insurance at Risk	Sound Value	Loss
1918.....	65	$2,622,227	$3,350,580	$1,087,416
1919.....	93	4,500,625	5,684,329	1,080,458
1920.....	90	7,105,818	10,161,252	2,335,160
1921.....	62	3,459,221	4,668,940	1,450,449
Totals.....	310	$17,687,891	$23,865,101	$5,953,483

The River Rouge Plate Glass Plant of the Ford Motor Company

The First Officially Authorized Description of the New Factory in Operation

By Fred J. Huntley

The steady increase in the demand for Ford cars has, as is well known, made necessary the building of another plant much larger than the original Highland Park factory for the quantity production of glass windshields. For several months the Ford Motor Company has been producing high grade plate glass in the new units erected at its great plant on the River Rouge, just west of Detroit, where it is also manufacturing castings and other products that enter into the construction of its motor cars and tractors.

The glass industry at "the Rouge," this being the way general reference is made to the Ford industries in that part of the city, is the result of persistent experiments carried on for several years at the company's plant in Highland Park, a northern suburb of Detroit.

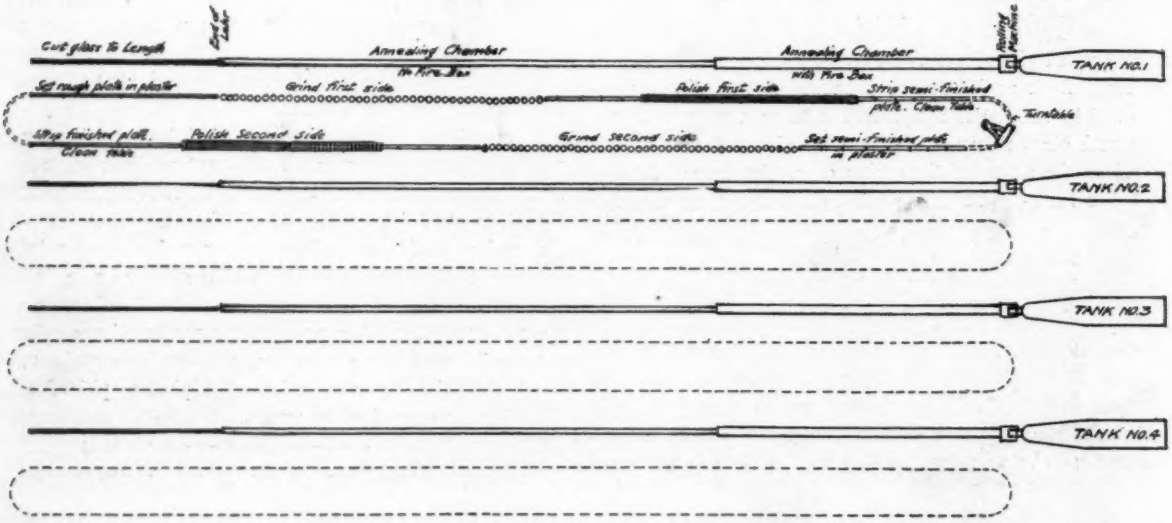
There is nothing experimental in the operation of the River Rouge plant. The initial difficulties have been overcome and the glass which is being produced is very free from ordinary defects. The method of flowing glass from the tank is along the lines of an enlarged feeder operation. The polishing and grinding operations, though along standard lines, are unique in that they are made continuous by mechanical means. The plant is under the management of H. A. Avery who has entire charge of all glass interests of the Ford Motor Company.

The demand for closed automobiles has taxed the existing plate glass plants to the utmost. It is estimated that in 1923 ninety million square feet of plate glass were produced in this country and that fully 45 per cent of the output was used in the manufacture of automobiles.

Ford officials make no statement regarding how much glass is being produced at the big plant in River Rouge or at the plant in Highland Park, but they do say the Rouge plant was designed to meet the demands for the production of 1,000,000 motor cars annually. But since then the Ford production schedule has been increased several times. It is believed from this that the Ford company's output, even with the new plant in operation, is not sufficient at present to meet all of its demands.

Back in 1919 the Ford Motor Company found among other problems difficulty in obtaining a sufficient supply of glass. Deliveries were uncertain and at times the production schedule was threatened. Failure of glass deliveries might at some time cause the entire plant to slow down or even to close. A ready supply of glass is just as essential in motor car construction as steel or other metal products.

The company began long and costly experiments with the result that since October, 1922, it has had one glass furnace in almost continuous operation in Highland Park and the new plant at the Rouge since last August. The plant at the Rouge is 760 feet long by 240 feet wide. The melting section is 258 feet long by 100 feet wide. It contains four furnaces, two of which have been flowing continuously since they were started. The third furnace is now being brought up to heat and soon will be in full operation. The fourth furnace will not be started for some time. The company is planning further experiments in the way of economy and efficient operation. An attempt will be made at first to operate the four grinding units from glass flowing from the three furnaces. This has not been undertaken yet but the company's glass superintendent believes it may be successfully accomplished, though he states that it is impossible to be sure of it until the scheme has been tried out.



LAYOUT OF THE FORD MOTOR COMPANY'S PLATE GLASS FACTORY AT RIVER ROUGE, NEAR DETROIT, MICHIGAN

If he can work this out successfully it will further speed production and reduce operating expenses as well: At the same time one furnace would always be in reserve for emergency use.

Furnaces at the Rouge plant are 78 feet long, 16 feet wide at the melting end, taper to a six foot radius at the spout end and are set 50 feet apart. Each has a capacity of 400 tons and melts about 40 tons every 24 hours, consuming about 520,000 cubic feet of gas during that period. Each furnace with its lehr, grinding and polishing equipment is termed a unit. Each unit is made up of one furnace, 86 grinders and 72 polishers arranged according to the diagram presented on the opposite page.

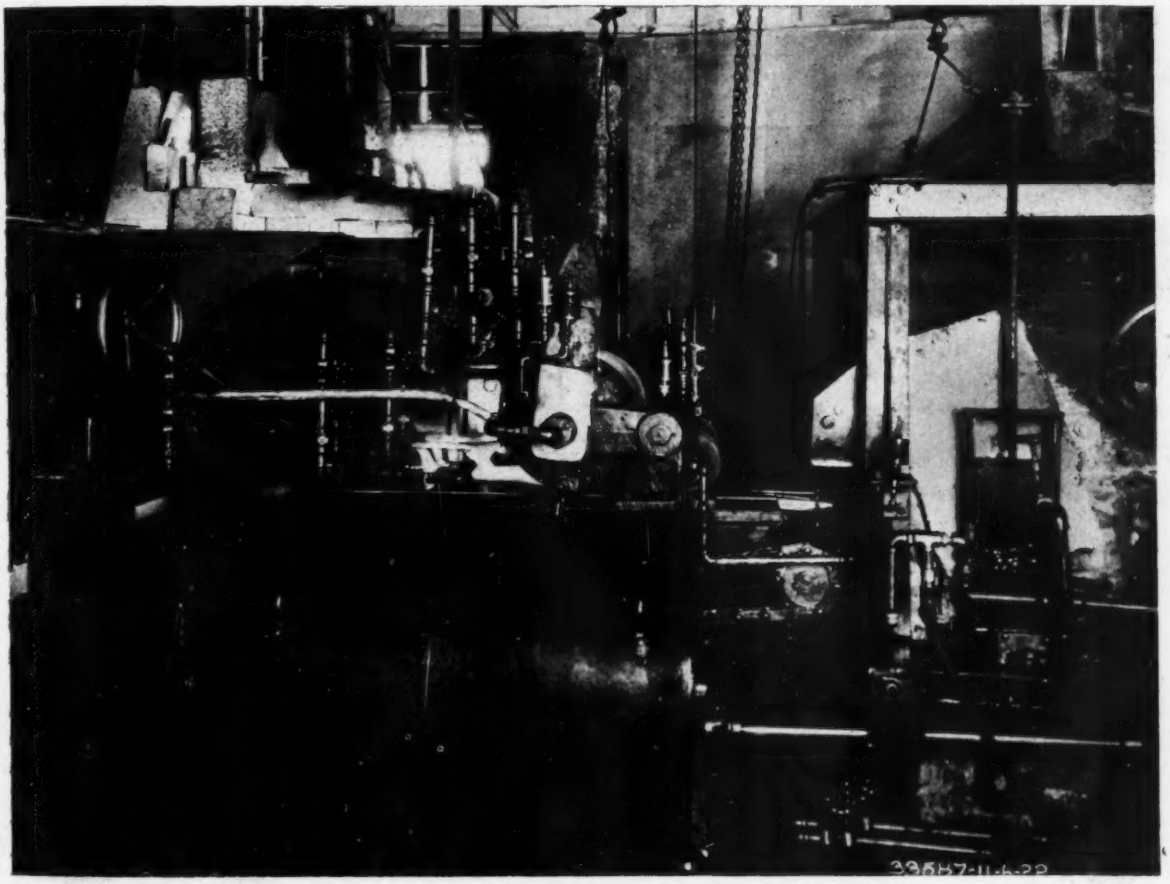
The batches fed into each furnace are made up of the following proportions:

Sand	438	pounds
Limestone	112	"
Soda ash	131	"
Salt cake	24½	"
Charcoal	1¼	"
Arsenic	1½	"
Cullet	155	"

The furnace fills, of course, are governed by the speed of the glass flow. They are supposed to occur every 20 minutes but the process at times is more frequent than that.

The molten glass flows from the furnaces at a temperature of 2,000 degrees F. It is further heated in the feeder to 2,150 degrees F. and flows onto a table of metal plates, passes under rollers of nichrome metal and thence upon rollers into and through a lehr 442 feet long.

Each of the lehrs is operated by two ten-horsepower electric motors. Pyrometers placed at intervals control the temperature. The glass passes down the lehrs in a continuous strip and gradually cools from about 1,075 degrees to about 80 degrees. This takes about 1 hour and 20 minutes. About 7 square feet of glass is produced every minute. As the ribbon of glass emerges from the lehr it is cut by hand into sections 9 feet, 5 inches long, the size of the grinding tables. Each sheet contains glass for three complete Ford windshields and weighs in the rough, 75 pounds. After grinding and polishing the weight is reduced to 51 pounds.



FORD CONTINUOUS-FEED GLASS ROLLING MACHINE

The molten glass flows directly from the melting tank, passes under rollers which flatten it to the proper thickness, and is conveyed into and through the lehr in a continuous sheet.

(Reprinted from the January, 1923, issue.)

At the end of the lehr the glass is placed on tables mounted on wheels and embedded in plaster of paris, and made ready for the grinding and polishing processes.

When the plaster becomes sufficiently hard, the tables are started along the tracks towards the first machines where the sand grinding process begins. The tables come in contact with a chain which conveys them under the grinders. These are rapidly revolving discs, duplicates of those

used in the Highland Park plant. The sand is allowed to flow on the discs and is distributed over the surface of the glass by means of centrifugal force.

The sand, as it passes over the glass, comes in contact with water. In this way after being used it flows off into

FORD GLASS GRINDING MACHINES

a gutter running under the machines, and eventually finds the way into a grading tank and is separated into the different sizes, and used over and over again until it becomes so fine it is finally discarded.

All the glass passes through eight grades of sand before it meets the polishing machines. The grinding and the polishing processes are exactly the same as worked out in experiments in the Highland Park plant which were fully described in the January, 1923, issue of THE GLASS INDUSTRY.

After passing down one side of the unit, one side of the glass has been ground and polished. The pieces then are turned, reimbedded in plaster of paris, transferred by means of a turntable, and passed back again on the other side, going through similar grinding and polishing operations, which complete the process. The glass is then removed from the tables, washed and is ready for use.

Each of the 86 grinding machines is operated by a five-horsepower electric motor. Each polisher is operated by a ten-horsepower motor. A Fordson tractor worm gear is used for adjusting the head mechanism of each grinder and polisher.

The glass, as heretofore explained, flows from the furnace in a continuous strip the entire length of the lehr and is rolled 3/8 of an inch thick and 40 inches wide. On one unit, No. 2, a strip of glass 42 inches wide is produced. Otherwise it is just the same as the strip turned out from the No. 1 unit and goes through the grinding and polishing processes in the same way.

Every bit of the glass machinery was installed by the Ford Motor Company itself and about one-quarter of it manufactured in its own plant. The remainder was purchased from outside sources.

When asked about problems encountered in building the plant and installing its machinery, the superintendent said there were no problems encountered worth mentioning. The problems, he said, had all been solved before work was started on the new plant. Extensive glass production was not attempted until the Ford management was sure of what it was doing. The glass manufacturing methods are practically a duplication of those in the Highland Park plant, but of course on a much larger scale. It is the same way with the equipment. It was only found necessary to make a few unimportant changes.

The new glass plant is a part of the River Rouge Ford industry, where the company has a vast stretch of land devoted to the manufacture of steel, electric power, gas and tractors. The motor cars are manufactured in Highland Park.

The River Rouge has recently been dredged so that the largest of lake freighters steam from the Detroit river into the very center of the plant and unload supplies of every kind.

FORD GLASS POLISHING MACHINES

Gas to operate the glass plant is manufactured in great quantities. In fact so much is produced from its coke ovens that a large volume is sold to the Detroit City Gas Company for municipal purposes.

Coal is shipped to the River Rouge plant over the Detroit, Toledo and Ironton railroad, which also is owned and operated by Henry Ford and his son, Edsel. The coal comes from the Ford mines at the southern terminal of their railroad.

The new glass plant has everything at hand for economical and rapid production. Labor is easily obtainable and the men are paid on the regular Ford working plan—six dollars a day being the minimum and from that on up according to service and skill. The plant is light, well ventilated and kept scrupulously clean.

Competition whose motive is merely to compete, to drive some other fellow out, never carries very far. The competitor to be feared is one who never bothers about you at all but goes on making his own business better all the time. Businesses that grow by development and improvement do not die. But when a business ceases to be creative, when it believes it has reached perfection and needs to do nothing but produce—no improvement, no development—it is done.

—Henry Ford.

Insulation of Glass Tanks*

By W. K. Brownlee[1]

The walls and bottom of a glass melting tank are insulated to give a longer life. The cause of rapid erosion must be determined before the remedy can be devised.

The tank blocks are more or less porous which gives opportunity for fluxing of the glass constituents with the clay of the tank blocks. The clay base undergoes alteration and is flushed away into solution exposing fresh surfaces to further reaction.

An outstanding feature of the effect of erosion is the uneven vertical corrugations down the walls of the furnace and it was this that raised the question of insulation as a means of preventing or reducing to some extent the convection currents that are moving downward over the inner surface of the clay walls drawing down with them the most active fluxes from the hot surface. The walls of a pot suffer less from erosion than the walls of a tank, and it is possible that because the direction of the currents in a pot is directly opposite to what it is in a tank, that pot walls are not subjected to the hottest action of the fluxes. In the pot the convection currents are going up the walls from a cooler temperature zone and in the tank they are going down the walls from the highest temperature zone.

It is true that the colder the walls of a tank, the more the convection currents are accelerated. It is also probable that a wall of even thickness (no matter how thick) would not stop convection currents. So in the construction of this experimental tank we exposed six inches of the top row of the blocks to the atmosphere, and increased the thickness of a wall toward the bottom to compensate for downward heat losses.

The flux block lining of the tank was 8 inches thick in the wall, and the size of the tank was 4 feet wide, 6 feet long and 2 feet deep. The bottom was of 12-inch flux blocks, 12 x 18 x 24 inches. These were placed on solid masonry (fire brick), 24 inches thick under which was a course of Sil-O-Cel, 2½ inches thick. The base was 13 inches larger than the space covered by the tank blocks. We then placed a 9-inch wall of good high grade fire brick laid tight and neat against the outside of the lining, 4 courses high. Then the thickness of this lining was reduced to 6 inches for two courses of brick in height, the finish was a row of brick 2½ inches thick. Outside of all this was a facing of Sil-O-Cel (2½ inches thick) and steel bracing was outside of all masonry.

The tank was operated for 30 days at 2,500° to 2,600° F., melting from 1,500 to 1,600 pounds of raw batch without cullet, each 24 hours.

Fixed amounts of batch were introduced at regular intervals, in one end of the furnace, and the melted glass was ladled or gathered from the other end from a cylindrical ring with holes in the bottom for passage of the glass to the ring. In other words the tank was operated as a continuous melting furnace for 30 days.

At the end of this period the fire was let out for observation of the action of the operation on the tank walls.

There was no evidence of vertical lines of erosion, or any loss of metal through joints or masonry.

In discussing this question with glass manufacturers, we find a number that see much merit in the idea. Some raise the question of leaks through the wall and the answer to this is, a high grade fire-brick wall of the right quality of clay will not wear out or leak glass through it, until it becomes exposed to the action of fluxes, and this will not occur until the furnace lining has been removed by erosion, and loss through erosion on the lining will be reduced correspondingly to the retarding of convection currents.

DISCUSSION

MR. CRAWFORD: How much corrosion was there in the block in that period?

MR. BROWNLEE: In the 30 days there was no noticeable corrosion at all.

MR. CASSELMAN: I do not comprehend your explanation for the absence of the channels in the block.

MR. PAYNE (Chairman): As I understand it, as the glass came in contact with the wall of the tank it was cooled. Thus the glass was more dense after it was cooled than the glass near the center of the tank or underneath it, hence it would sink. When the outside wall of the tank was insulated the edges were not cool and, therefore, there was none of this downward movement at the sides and upward in the center and across the top.

MR. REED: Where could information be obtained as to specific gravity of glass at various temperatures from 200° up?

DR. INSLEY: I believe the Geophysical Laboratory has done some work on the specific gravity of other materials at high temperatures and perhaps on some silicate glasses, but not commercial glasses.

MR. REED: Inasmuch as this entire discussion hinges on the vertical flow of glass, and on the specific gravity, some very definite information should be used to back up the theory and results claimed. There is absolutely no information which has come to light which gives the specific gravity of glass at anywhere near 2,000° F.

MR. YUNG: I wonder if it is a question of specific gravity or whether it is a matter of viscosity. It always seemed so to me, but I have never had an opportunity of trying it out. A number of people have taken the measurements of the glass temperature on the surface of the tank and at the bottom and on 42-inch depths it was found to differ by as much as 400° C. The most noticeable place of corrosion, according to my observation is over the throat of the tank, the throat block of course getting the greatest amount of corrosion, but also the block immediately over that throat block corroded away before the side blocks of the tank, and I have often wondered if perhaps that did not mean that we were drawing a larger tonnage over that surface than we did over the lower parts

*Jl. Amer. Cer. Soc., Vol. 7, No. 6. (June, 1924.) Presented at the Atlantic City meeting of the society, February, 1924 (Glass Division).

[1]Buckeye Clay Pot. Co., Toledo, O.

of the tank. There is always the thought, of course, that the temperature increases corrosion, but I think there are other factors which should be considered. The lower part of the tank may be so cold that perhaps there is very little motion of the glass there, consequently very little corrosion, not much pulling away of small particles of clay block from the surface and exposing new surfaces, whereas on the surface of the glass you have less viscosity and consequently a greater flow exposing a new surface continually which might perhaps explain the greater amount of corrosion at the metal line. The matter of insulation might help overcome this feature by increasing the amount of insulation in proportion to the drop in temperature of the glass from the surface to the bottom giving a more uniform temperature condition throughout the depth of the glass which would tend to move a greater mass of glass in the tank than just the surface.

MR. DIXON: In every instance known where insulation has been used on the tanks, we found that it decreased the life of the tank very materially, that the blocks disintegrated very much more rapidly, and experience in this always brings up many things that are really mysterious to those engaged in the business.

Mr. Yung's suggestion about the corrosion around the throat is one peculiar result that is known to everybody employing tanks of this kind, that is, the double compartment tank. One tank may have a production of 50 or 60 tons a day going through the throat. Another may have 15 or 20 tons production a day going through a throat the same size and the 60-ton tank will last just as long as the 15-ton tank. That seems to absolutely contradict the natural result that might be looked for, and yet, it happens.

To prolong the life of the tanks, everybody has tried just the opposite of insulation. They have air blown on the outside of the blocks to cool them or use water jackets in order to prolong their life. There is an experience I had some years ago. An accident happened to the furnace and it had to be put out about five weeks after it was started. It was a breaking bridge wall, and all of the glass ran into the basement. When the furnace was cooled we found the walls were so badly eaten away in that five weeks that it was most astounding. It was the first time I had ever seen a furnace let out in such a short time, and I could not advise the owners of the tank whether to leave the blocks in or to replace them. They replaced them. I have had that experience several times since and I have come to the conclusion that the inside portion of the block is eaten away in a very few weeks. The outside 4 or 5 inches will last indefinitely if kept cool, so that it is proven that the thicker the walls the more rapidly they disintegrate.

One of the first tank undertakings in this country was a most ridiculous proposition. The window glass tanks that were built at Jeannette in 1887-88 were built by people who had no engineering capacity or knowledge of the subject whatever, and I was one of them. They made the walls of those tanks 39 inches thick, and in a few weeks all the blocks had sloughed off and all that clay material had gone into the glass until the tank walls were about 10 or 12 inches in thickness, and then it remained for an indefinite time.

What was the use of 39 inches of wall in a furnace of that kind?

These things all tend to convince me that insulation of the tank block walls is working in the wrong direction. If the walls of much thinner blocks are kept cool, it has been frequently demonstrated they will at least last longer in the outside portion. I have never seen a tank that was insulated that has run any length of time.

A six weeks' or four or five weeks' test, such as has been described here is not a test of sufficient length of time to prove anything. It should be a test of a year to give data for any positive conclusions.

MR. AURIEN: From my experience I would concur with Mr. Dixon. I feel that the inside of the blocks could be expected to have some protection by your glass devitrifying, or in a sense, a dormant glazing. Now if you heat the outside of the blocks the tendency is to keep that much hotter and bring fresh metal in contact with the newer clay at the surfaces. I think what we want is cooling instead of heating up to prolong the life of the furnace.

MR. YUNG: Mr. Brownlee happened to have talked with me on this matter some time ago, so that I am familiar with his idea and theory and to open the discussion I was simply presenting his idea to straighten out the thought and start the discussion. It seems to me that there is so much that is unknown about the life of a tank, the causes for failures in the tank, that I think it well to study the subject from the various angles. For example, the matter of the short life of a 39-inch block in a tank, which Mr. Dixon speaks of, might not have been due to the increased amount of heat on the inside surface as much as it was to poor construction of the block. As any of the clay men here will probably admit, it is also a rather difficult proposition to properly burn a 39-inch block and get a homogeneous burning throughout, and if it is not burnt properly the interior of the block will be soft and is not going to last very long. I only mention this as a factor to introduce some discussion which may come up later from the causes for failures of tanks, which I think is well worth discussing.

MR. DIXON: The insulation of the refining compartment is old. We have been doing it for years, ever since we started to build these two-compartment tanks. The insulation consisted of a brick wall outside of the tank block wall on the refining compartment. That has become very dangerous now because the man who runs the furnace has to run the glass hotter. The machine production requires hotter glass, and we have had to take the insulation off of the working compartment.

MR. FLINT: I just tried to jot down a few things from memory that we took from some tanks; some of them are the averages of a few hundred. Approximately 5% or 6% of the heat, as I recall it as the average, is used up in melting and bringing the glass up to proper temperature, and about 5 or 6% is taken out by the hot glass as it leaves the tank, which is necessary because it has to be used hot on the machines. The stack carries a little under 20% of the heat. In other words, putting it in dollars for every dollar's worth of heat you are expending about 19 or 20 cents on the stack. That is not all loss, because ¾ or more of this is used in mechanically lifting the products of combustion out of the down-going checker chamber. The rest of it is due to radiation.

In our practice approximately ½% to 3½% of the heat value of the gas is lost in excess air. That gives approximately 28% to 30% of the heat that is put into the tank. The rest of it is lost by radiation. This heat was distributed about as follows: Regenerators and the flues took about 6%; the regenerators themselves probably lost about 3%. In other words, 97% of what went in went back into the tank. Some of that we could have corrected by insulation. The flues took out some; the crown, as we calculated it, took around 20% or a little under, the front half probably takes 8% or 9% and the back half 9% or 10%, because it gets more of the direct flame, and the off-takes took more—nearly 15%.

You cannot say, however, that that is true of all off-takes; ours might be a little more chopped up than the rest, although I do not believe so. The off-takes present as much surface to the air as the crown will and in such a way, like a radiator, that they give off the heat. The side and the bridge together take about 20% or a little under, according to the glass, the heat, etc., and the bridge takes about 10%.

If you are going to economize on fuel you will find it is a big loss.

We figure that there are only two ways to correct this: Increase the amount of glass that goes through the tank so that that which is exposed to the heat can take it up and pass it on to the used article. If you raise the amount of heat that the glass gets and increase it 10% to 20%, you are getting it directly back in your own pocket, but you cannot do that generally.

The stack can be improved a great deal. Some stacks have rather thin walls, some of the steel stacks may have a small layer of brick, and they could be protected some. That only represents 5%. Most of that is necessary to the crown, etc., it is possible and it has been done. To insulate, we shall take the worst one, the off-takes—the fire is going right into the off-takes from the tank and has practically got the temperature of the flame. It is a high potential for heat loss and there is plenty of surface for radiation. Those have been insulated—they are beginning to do it with steel plants and are successfully doing it. I believe with Mr. Dixon that it is perfectly all right to insulate the front end of the crown, and I even feel that we can do it now with our high temperature. When it comes to the side wall and the bridge, we are buying bigger blowers and putting more of them on there, because the tank boxes that used to last are not lasting now and we are trying to do our best to hold them. The measurements we have taken of the amount of wind delivered to tanks for side wall and bridge wall cooling have indicated somewhat in a rough manner, although it is hard to check, that the tanks with the least amount of wind are not doing quite so well. When we give them more wind we feel that we are getting better results out of them. If the flues, which are sometimes in damp ground, which is one of the nicest conductors of heat there is, could be insulated and water-proofed, it would help out. I find that the Illinois Pacific Glass Company, who are burning oil, have insulated a 12-inch crown with two layers of silica on top and insulated their off-take and they have done that for two fires at least. Well, if that's the case I do not see why—they insulated, by the way, the back end as well as the front end of the crown—I do not see why we could not go part way on that. I do not know that I would insulate the back end as it is such a proposition but I am just citing it as a fact. It has been done and has worked but I do not know anybody who has successfully insulated a flux block and kept the block there.

MR. BROWNLEE: The discussion is mostly unfavorable to the idea proposed. I observe that the prevailing thought is that the insulation is sure to create a higher temperature in the blocks which will cause the clay to be more easily attacked as evidenced by the more rapid corrosion when excessive temperatures are used. As a matter of fact just the reverse of this is true.

Due to cold bottoms and side walls of glass tanks a rapid movement of the metal is set up over an area that represents about one-third of the total melting area. This of course reduces the time factor for melting to one-third of what it would be, if the body of glass was all equal in temperature and viscosity, so under a slower and more uniform movement of the entire body of glass a *lower temperature* would, with the *increased time* allowed for the melting, be used.

This slower and more uniform movement of the entire body of glass cannot be obtained by cooling the walls and bottom. The cooling of the side walls does produce convection currents or rapid precipitation down the walls, also a surface tension of glass on clay, which probably removes the clay very rapidly while the wall is of full thickness. It may be that at this time, surface tension is all on clay and it may be that when the wall has worn to a thinness through which sufficient cooling can be transmitted, the surface tension is removed from the clay wall and the tension is then on the glass which is held congealed on the wall. If clay walls should not be kept at a high temperature, how was glass ever made in pots profitably? Pots do not suffer from corrosion as do tank walls, and yet all the temperature must be conducted through the walls, and if it were not for the shrinkage cracks that come on the inner face of pot walls, due to sudden cooling when batch is introduced, the pot walls would last as long or longer than tank walls.

This is due to proper heat conditioning of clay which is a natural sequence with pots, and clay to withstand the action of glass should be burned to a temperature in excess of the temperatures to be used in melting glass. This will insure against physical change through shrinkage, and greatly decrease absorption of alkalies.

If we were to attempt to burn tank blocks to the degree of temperature required to condition them the best, we would first have to consider the practical dimensions of blocks that could successfully be burned to the right degree without excessive losses, and the difficulty of reheating when placed in the tank walls.

I am of the opinion that this can be done with blocks that do not weigh over 125 pounds, and suggest these blocks be not over 8 inches thick, 12 inches wide, and 18 inches long, or even less than this, say 8 x 8 x 12 inches. The number of joints is not as important as to get the general condition correct to make insulation do in the glass business all that is possible for it to do in any other line. Insulation does not create temperatures that are disastrous to clay blocks. The temperature that does is created from another source which it is desirable to reduce to the advantage of the clay blocks and conservation of fuel.

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CONTENTS

	Page
The Umbrascope	119
The River Rouge Plate Glass Plant of the Ford Motor Company	122
Insulation of Glass Tanks	125
Editorial:	
Keeping Up the Morale	128
Technical Consultation Service:	
Seeds in Glass	128
United States Government Specification for Flat Glass for Glazing Purposes	129
Recent Patents	132
Glass Factory Equipment and Supplies:	
New Link Belt Vibrating Screen	134
Lammert Pressure and Vacuum Pump	134
Refractories Directory and Book of Brands	134
The Glass World and What It Is Doing:	
National Physical Laboratory Report	135
Sample Fair of the North Bohemian Glass Industry	135
Automatic Insulator Press at Lynchburg	136
Proves Value of Glass Containers for Protecting Candy from Deterioration	136
Summer Trip of American Ceramic Society	135
Window Glass Price Guarantee	137
Industrial Publications	137
Verified News of Trade Activities	137
Recent Deaths	139
Coming Meetings	139
What the World Wants	139
Inquiries Received	139
Stock Quotations	139
Current Prices of Glass-Making Materials	140
Monthly Summary of U. S. Foreign Commerce in Glass	140

CLASSIFIED BUYERS' GUIDE, PAGE 20
INDEX TO ADVERTISEMENTS, PAGE 22

Readers of THE GLASS INDUSTRY in the United States and elsewhere are requested to favor the Editor with any information available from time to time concerning developments in their own or other fields which would be of general interest to the industry. Authoritative facts about new glass manufacturing projects, re-organizations, new factory construction, new processes and equipment, raw materials, manufacturing and market conditions, personal items, and other appropriate subjects would be welcomed.

Those experienced in the practical, technical or executive activities of glass manufacturing who are qualified and willing to lend their aid to the upbuilding and progress of the industry by giving from their store of knowledge to others, are invited to submit for publication articles on any subjects relating to glass which would be of interest and value to our readers. The authors of accepted articles of this kind will be compensated at usual rates.

Keeping Up the Morale

The success of the eight-hour day in the steel industry has been a striking example of the influence of the morale of a working force on the earning capacity of a corporation. When requested to reduce the number of working hours from twelve to eight, executives of the United States Steel Corporation stated that the change would wreck the industry. A few months later the change was made and instead of disorganization and ruin the corporation's report showed an increase in earnings.

Every one who has been intimately associated with laborers, whether skilled or unskilled, routine workers or those of whom a high degree of intelligence is required knows that the great majority of men desire to fulfill their obligations toward their employers to the best of their ability. To keep up the desire to do a task well is the first principle of good management; it requires the proper recognition of results attained. There are certain men who can get twice the amount of work out of a group of workers than others. Keeping up the morale of an organization is just as important as keeping the machinery repaired and oiled.

Aside from the proper choice of managers, scientific control of working operations is one of the most powerful factors for creating and upbuilding the morale of a working force. In the glass industry self-registering pyrometers do more than control temperatures. The use of these instruments puts the job of maintaining the proper temperature up to the men in charge. There can be no evasion, no shifting of responsibility. The desire to do one's work well is rewarded by the knowledge that results are self evident and are sure to be appreciated.

The checking up of batch mixing operations by frequent analyses and by analyzing the finished product, is another case in point. It is a source of satisfaction to the members of the batch mixing department to see the accuracy of their work verified by the chemical laboratory. Thus scientific control has a two-fold result. It increases output and improves quality and for the workers it creates the incentive to render service to the best of their ability.

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions than those printed are invited to submit them. Questions should be submitted in writing and will be answered by mail as promptly as possible. The sources of all inquiries will be held in strict confidence.

Question 57.— Seeds in Glass. I would like to take advantage of your offer to answer questions that have to do with glass technology. My question is as follows: What makes glass seedy and how is it eliminated?

Answer.—Seeds or blisters are gas bubbles which remain in the glass. The gas may be air, carbon dioxide, sulphur dioxide or carbon monoxide. They may be caused by lack of heat in the furnace, by excessive heat, causing volatilization of the alkalies, by carelessness in the mixing of the batch, excessive alkali in the batch, insufficient air to allow complete combustion of the fuel gases, or by faulty construction and lack of room in the combustion chamber.

During the reaction between soda ash, limestone and sand, a large quantity of gas is formed. Unless all of this gas is

completely eliminated from the molten glass, seeds will appear.

To obtain a complete reaction between the batch ingredients they must be present in the proper proportions and must be mixed thoroughly. The temperature must be sufficiently high for the reaction and enough time must be allowed for the fusion to take place. If these conditions are fulfilled the gases formed will escape. If, however, the molten glass is too viscous some of the gas bubbles will fail to reach the surface and seedy glass is the result.

Large blisters are often caused by the presence of metallic iron which may be introduced with the cullet. For this reason it is advisable to clean the cullet, before use. An electromagnet will do valuable service by removing the iron present.

From the foregoing it may be seen that glass is liable to show seeds due to a number of different causes. No remedy can be suggested without a careful study of each individual case.

In general it may be said that seedy glass can be avoided by careful control of temperatures, regulation of the stack draft and by having the proportions of the batch right. Arsenic is often used to aid in bringing seeds to the surface, owing to its own volatilization.—J. B. K.

United States Government Specification for Flat Glass for Glazing Purposes

Federal Specifications Board Specification No. 123

This specification was officially adopted by the Federal Specifications Board on April 1, 1924, for the use of the Departments and Independent Establishments of the Government in the purchase of flat glass for glazing purposes. It became mandatory for all Departments and Independent Establishments of the Government on July 1, 1924.

Classification

- Polished Plate Glass
  - Second silvering quality
  - Glazing quality
- Clear Window Glass
  - Single strength
    - A Quality
    - B Quality
  - Double strength
    - A Quality
    - B Quality
  - Heavy Sheet
    - Glazing Quality
    - Factory Run
- Processed Glass
  - Chipped
    - No. 1 Processed
    - No. 2 Processed
  - Ground
    - Acid Ground
    - Sand Blasted
- Rolled Figured Sheet
  - Figured Sheet
    - Large variety of patterns
  - Colored Figured Sheet
- Wire Glass
  - Polished Wire
  - Polished (one side)
  - Figured
  - Corrugated
  - Colored
- Ornamental
  - Figured Plate (polished one side)
- Prism Glass
  - Pressed Tile
  - Rolled Sheet
  - Rolled and Pressed Sheet

Definitions of the General Classes of Plate, Clear Window and Rolled Sheet Glass

PLATE GLASS—Transparent, flat, relatively thin glass having plane polished surfaces and showing no distortion of vision when viewing objects through it at any angle.

Plate glass is made at present by casting and rolling large sheets periodically or by rolling a continuous sheet. The sheets are then ground and polished.

CLEAR WINDOW GLASS—Transparent, relatively thin, flat glass having glossy, fire finished, apparently plane and smooth surfaces, but having a characteristic waviness of surface which is visible when viewed at an acute angle or in reflected light.

Clear window glass is made at present by hand blowing or by machine blowing and drawing into cylinders and flattening, or by drawing directly into a sheet, the surface finish being that obtained during the drawing process.

PROCESSED GLASS—There are three kinds of processed glass either in plate or window glass, viz: ground glass, chipped one process and chipped two processes. The ground glass is made by either sand blasting or acid etching of one surface. The chipped glass is made by applying either one or two coatings of glue to the ground surface.

ROLLED FIGURED GLASS—A flat glass in which the vision is more or less obscured either by the roughened surface produced in rolling or by the impression of a large variety of decorative designs on one surface of the sheet.

WIRE GLASS—Rolled flat glass having a layer of meshed wire incorporated approximately in the center of the sheet.

This glass is produced with polished or figured surfaces.

ORNAMENTAL PLATE—A figured plate glass made by rolling or rolling and pressing and having the plain surface ground and polished.

PRISM GLASS—A flat glass having prism shaped parallel ribs designed for deflecting light.

This is made as a rolled plate or as a pressed plate, of which one side may be ground and polished, or as a pressed tile.

Detailed Specifications of Various Types of Glazing Glass

GENERAL PRINCIPLES INVOLVED IN GRADING GLASS

All flat glass contains some imperfections and the principle employed in grading is to exclude all defects that would be objectionable in a given grade. This is difficult to do since there are no sharp lines of demarcation between grades, and experienced inspectors will differ in judgment as the quality of the glass approaches the limits of the grades. Small lights must be quite free from imperfections as compared with larger ones, and the center of any sheet should be clear whereas the edges may contain more pronounced defects.

METHOD OF EXAMINATION—The method of examination is described in these specifications in order to make the results more uniform and defines the condition under which glass should be examined because the distance from the glass, the angle between the glass and the line of sight, and the intensity of light all affect the visibility of imperfections.

These specifications should be interpreted by examining the glass in the following manner, with reference to the definitions of defects listed in the glossary:

The glass should be examined when placed in a position similar to that of a glazed light with the observer's eye on a level with the center of the sheet, and looking through the glass from a distance of about 36 inches into the light from a clear sky without any sun or any close background.

The visibility of waves, lines or cords depends chiefly upon the angle of observation, and the intensity of these defects can be classified on this basis. The values given for angles are the angles the line of sight makes with the sheet of glass when in a vertical position. Slight movement of the head horizontally through an angle of two or three degrees will make waves or lines more perceptible.

ACCEPTANCE OR REJECTION—Acceptance or rejection of a ship-

ment or delivery shall be based on an examination of the following quantities:

For orders of 100 lights or less, all shall be examined; for orders of 101 to 500 lights at least 50 per cent shall be examined; for orders of 501 or more lights at least 25 per cent shall be examined. Boxes shall be selected from the shipment at random.

If not more than 10 per cent of the lights examined are below quality, the shipment shall be accepted provided the lights below the specified grade are not distinctly below the upper limit of the next lower grade.

If, however, an entire shipment of 500 lights or more is examined, not more than 5 per cent may be below quality.

Specifications for Polished Plate Glass

SIZES AND THICKNESS—The standard thicknesses of plate glass shall be ⅛, 3/16, ¼, ⅜, ½, ⅝, ¾, 1, 1¼, and 1½ inches. Sheets are available ¼" thick in sizes having a maximum area of 250 sq. ft. Glass of ¼" thickness may be furnished having almost any desired dimension under the following maximums: 120" x 280", 144" x 260", 160" x 240".

The standard stock thickness for glazing purposes is ¼ inch, but this may vary between 7/32" and 5/16", although ⅛" and 3/16" glass are carried in stock in the larger cities.

TOLERANCES IN THICKNESS—The maximum and minimum thicknesses allowed shall not be more than the given thickness plus or minus one-half the difference between the standard thicknesses, although for ¼" glass occasional plates as thick as 5/16" are supplied. The general variation in thickness should not be more than 1/32" for individual lights under 10 sq. ft., in thicknesses up to ¼". The variation in lights over ¼" in thickness should not exceed one-half the total tolerance for that thickness.

TOLERANCES IN DIMENSIONS—Variation from dimensions ordered shall not be more than 1/32" per ⅛" of thickness.

GRADES—Plate glass shall be furnished for glazing purposes in one of two grades as specified. These grades will be known as second silvering and glazing qualities.

Second silvering quality is invariably used where the highest standard of glazing is required and imperfections are discoverable only on close inspection. This quality is rarely sold for glazing purposes in sizes over 20 sq. ft. Glazing quality represents the usual selection of plate glass supplied when quality is not otherwise definitely specified.

As allowable tolerances in quality must vary considerably with size of sheet required, different specifications will apply in each of the following four divisions according to size:

Division I—sheets up to and including 10 sq. ft. in area;

Division II—sheets having an area greater than 10 sq. ft. but not greater than 25 sq. ft.;

Division III—sheets having an area greater than 25 sq. ft. but not greater than 75 sq. ft.;

Division IV—sheets having an area greater than 75 sq. ft.

DIVISION I

Sizes Up to and Including 10 Sq. Ft.

SECOND SILVERING QUALITY—This glass shall not contain any major defects. The central area of this glass may contain only well scattered seeds. Ream, skim, short finish, and scratches which cannot be removed by buffing, are not permissible. The edges may contain coarse seeds, but none shall be larger than 1/32 inch in diameter.

GLAZING QUALITY—The central area of this quality may contain numerous scattered seed, including an occasional coarse seed, but no heavy seed. Small bubbles may occur on the edge. Stones, large bubbles, skim, ream, or long or heavy scratches are not permissible. Faint strings in the corners or upper edge of the light are permissible. The polish shall not show areas of short finish.

DIVISION II

Sizes from 10 Sq. Ft. to 25 Sq. Ft. Inclusive

SECOND SILVERING QUALITY—The central area of this quality may contain more numerous fine seed than the small sizes and an occasional coarse seed. The edges may contain occasional small bubbles and fine strings. No heavy defects or scratches which cannot be removed by buffing are permissible. The polish must be good and free from visible short finish.

GLAZING QUALITY—The central area may contain small bubbles and fine strings or ream which does not give visible distortion when looking straight through the glass, but no long or heavy scratches. The edges may contain bubbles over 3/32", visible scratches shorter than 10 inches, small areas of ream, strings, and small stones not larger than 1/32", but these defects should not be grouped nor interfere with the vision. The polish over the central area should be good, but patches of light short finish may be present about the edges.

GENERAL—None of the above grades or sizes may contain any heavy or long lines, streaks of ream, any bubbles larger than ⅛" visible poor polish, open bubbles, areas of skim, or stones over 1/32" in diameter.

DIVISION III

Sizes from 25 Sq. Ft. to 75 Sq. Ft.

GLAZING QUALITY—Lights of this size may contain numerous visible and larger imperfections not allowed in the smaller lights. But these must not be grouped or so prominent that they noticeably interfere with the vision. The central area of the plate shall be free from these larger defects.

The sheets may contain seed of any size but not heavy seed except in relatively small patches on the outer border of the sheet, occasional bubbles up to ⅛" in the center and up to 3/16" on the borders, strings, ream and skin in very limited areas if not causing a deformation of objects viewed through the plate, occasional scratches and small stones under 1/16".

Heavy ream, heavy cords, bubbles larger than 3/16" in diameter, stones larger than 1/16" in diameter, large fire cracks, areas of unpolished glass, easily visible poor polish, large open bubbles, or sand holes, are not permitted. The large defects should be confined to the upper edge and upper corners of the sheet, the lower and central areas to be relatively free from major defects.

DIVISION IV

Sizes Greater than 75 Sq. Ft.

Sheets larger than 75 sq. ft. may contain defects of almost any kind except that they must not show large areas of heavy seed or bubbles, nor have any defects which will cause spontaneous breakage, such as skim or large stones (⅛" diam.) or show any areas of unpolished glass.

Specifications for Clear Window Glass for Glazing

Clear window glass for glazing is made in several different qualities and in the varying thicknesses shown in Table I below.

Single strength and double strength window glass is regularly supplied in two standard qualities, known as A quality and B quality. A limited amount of this glass, known as AA quality, which is especially free from defects, is sometimes selected for special purposes and may be specified if desired. It must be borne in mind, however, that the total amount of AA glass produced by the manufacturers does not exceed 3 per cent of the total amount of window glass produced.

There is also a limited amount of single strength and double strength glass produced in a quality inferior to B quality, and is known as Fourth Quality. The amount of glass produced in this quality also represents a very small percentage of the total window glass produced.

A quality of single strength glass inferior to Fourth Quality is also produced in very limited quantities, and is known as C quality. This is the lowest grade of glass that is packed and marketed in this country.

Window glass is also produced in thicknesses heavier than double strength, and according to its thickness it is classified as (1) 26 oz. glass; (2) 29 oz. glass; (3) 34 oz. glass; (4) 39 oz. or 3/16" glass.

26 oz. and 29 oz. glass are produced only in A and B qualities.

34 oz. and 39 oz. or 3/16" glass are produced in glazing and factory run quality.

TABLE I.

Tolerances in thickness and average weight of clear window glass:

Classification	Thickness in inches Min.	Thickness in inches Max.	Number of lights per inch Min.	Number of lights per inch Max.	Average weight in ounces per sq. ft.
Single Strength	.080	.100	10.5	12.0	18.5
Double Strength	.111	.125	8.0	9.0	24.5
26 oz. Glass.....	.125	.135	7.5	8.0	26.0
29 oz. Glass.....	.135	.148	6.5	7.0	29.0
34 oz. Heavy Glass.....	.150	.175	6.0	6.5	34.0
39 oz. Heavy Glass.....	.176	.205	5.0	5.5	39.0

SIZES OBTAINABLE—The maximum dimensions recommended are:

	Width in inches	Length in inches
For single strength	40	50
For double strength	60	80
For heavy sheet	66	90

TOLERANCES IN THICKNESS—Thickness of individual sheets shall not vary more than one-half of the total variation allowed for that particular strength of glass as shown in Table I above, for sizes up to 50 united inches. For larger sizes variations in thickness may be equal to the tolerance allowed for that class.

FLATNESS—All clear window glass shall be relatively flat. Slight curvature, provided it is regular, will be allowed, but the maximum deformation or bow shall not make an arc higher than 0.5% of the length of the sheet. Reverse curve or crooked glass is not allowable.

GLAZING—Window glass should ALWAYS be glazed with the convex side out.

DIMENSIONS—Glass must be cut to dimensions ordered with an allowable tolerance of 1/32" per ⅛" of thickness.

A QUALITY

The defects permitted in this quality are faint strings or lines, slight burn, small seeds, small blisters, and light scratches.

No light shall contain all of these defects, and those present may not be grouped when in the central area of the sheet.

Strings, lines, or burn specks shall not be of such intensity that they are visible when observing the sheet at an angle greater than 30 degrees between the line of sight and the glass.

Waves shall not be visible at an angle greater than 20 degrees with the glass.

Blisters shall not exceed ¼ inch in length unless they occur near the edge of the sheet.

In general, the central area of the light shall be practically free from defects, and the appearance of the light as a whole shall be such that there is no perceptible interference with the vision as long as one is not looking through the glass at an acute angle.

B QUALITY

This quality admits of the same kind of defects as A quality, but they may be larger, heavier and more numerous.

Occasional scattered blisters not more than ½ inch long may occur over the central area of the sheet. Larger blisters up to 1 inch in length may occur about the bordering areas.

Waves should not be of such intensity that they are visible when observing the sheet at an angle greater than 45 degrees with the glass, unless on the border.

Burn spots may be visible when looking directly through the glass, but they must not cause any appreciable depression and the speckled appearance must not be so great as to interfere with vision when examining the glass in the specified position.

Heavy Sheet Window Glass

GLAZING QUALITY—The same specifications for selecting provided for A quality single strength and double strength glass shall apply.

FACTORY RUN QUALITY—This quality is the run of glass as produced by the factory. It may contain glass of very good quality and some glass of very ordinary quality. However, the glass that contains heavy cords, lines or strings over the entire surface, raised blisters, cap strings, stones or batch particles causing a rough surface, or depression, or having its surface covered with heavy burn, wrinkles, deep scratches or stone, shall not be included in this quality.

Specifications for Rolled Figured Sheet Glass

This type of glass is supplied in but one quality for glazing purposes. It is made in a wide variety of surface finishes which serve to obscure the vision as well as provide a decorative finish and also special patterns for increasing illumination by diffusion or deflection.

Figured sheet glass is made in the following thicknesses: ⅛, 3/16, ¼ and ⅜ inch, and can be obtained in size up to 48 inches wide and 130 inches long.

Specifications for Wire Glass

This type of glass is supplied in but one quality for glazing purposes. It is made polished and in a wide variety of surface finishes which serve to obscure the vision as well as provide a decorative finish and also special patterns for increasing illumination by diffusion or deflection.

Wire glass can be made in the following thicknesses: ⅛, ¼, 5/16, ⅜, ½ and ¾ inch. The standard type of wire used has a mesh about 1¼ inch by ⅞ inch, and is not lighter than 24 B. and S. gauge except for ⅛ inch, in which 26 B. and S. gauge wire is used. Wire glass can be obtained in sizes up to 60 inches wide and 144 inches long.

Corrugated wire glass is made in one thickness, which is about 5/16 inch. Deep angle sheets are 2½ inches C. to C. of corrugations and mesh with corrugated asbestos. Shallow angle sheets are 2-11/16 inches C. to C and mesh with corrugated iron.

Specifications for Glass for Absorbing and Intercepting Ultra-Violet and Infra-Red Rays

This glass may be made as rolled figured sheet or wire glass in flat or corrugated sheets. It shall be of such composition that not less than 80 per cent of the ultra-violet rays[1] and not less than 50 per cent of the infra-red rays are excluded.

[1]In order to obtain this value, the ultra-violet transmission including reflection should not exceed the following values: at 0.405 Tr. = 30 to 40%, at 0.365 Tr. = 12 to 15%, and at 0.313 Tr. = 0.5 to 1.0%.

Specifications for Polished Figured or Ornamental Plate Glass

Ornamental plate glass is a figured sheet glass, the smooth surface of which has been polished. It is made ¼ inch thick in sizes up to 50 inches wide by 100 inches long and in a variety of patterns. Chipped plate glass, single and double processed, is also sold as polished figured plate glass.

Specifications for Prism Glass

This glass is made as rolled sheet glass with or without wire and as a pressed tile. It is made with one side polished, sold as prism plate glass or as a rough rolled prism glass, and can be furnished in sizes up to 42 inches by 138 inches, ¼ inch thick, and in sizes between 42 and 60 inches by 138 inches, 5/16 inch thick. The prism ribs are furnished running horizontally with the length of the sheet. Prism wire glass is made in sizes up to 42 x 138 inches, with a thickness of ⅜ inch.

Pressed prism tile are made either 4 x 4 inches square or 5 x 5 inches square.

General Specifications for Rolled Figured Sheet Glass, Wire Glass, Ornamental Plate Glass, and Prism Glass

QUALITY—The glass shall contain no visible stones which may cause spontaneous breakage of the sheet, no fire cracks or exposed wire. The pattern shall be uniform over the surface without any easily visible blemishes.

TOLERANCE FOR THICKNESS—The total variation in thickness of this glass shall not be more than 3/64 inch for any single sheet; the maximum variation allowed for any specified thickness may not be greater than 3/64 inch over or under that thickness.

DIMENSIONS—Glass must be cut to dimensions ordered with an allowable tolerance of 1/32 inch per ⅛ inch of thickness.

Glossary of Terms Used in These Specifications

The various terms used in describing imperfections appearing in flat glass are the following: seeds, boil bubbles, blisters, open bubbles, cords, strings, ream, knots, scratches, light grazes, cullet cuts, sand lash, sleck, short finish, sand holes, feathers, skim, stones, waves, lines, burns, burn spots, and fire cracks.

Many of these terms may be grouped under one general term and a number are not necessary in preparing specifications, although they are often used in a factory as identifying certain imperfections.

The following terms shall be used in specifications:

Plate Glass		Clear Window Glass	
Seeds	Bubbles	Seeds	Strings
Short Finish	Open Bubbles	Blisters	Cords
Skim	Ream	Lines	Stones
Strings	Stones	Burns	
Scratches	Fire Cracks	Scratches	
	Sand Holes		

Definitions, causes and brief description of these various imperfections are given herewith.

BUBBLES—Gas inclusions in any rolled glass. These inclusions are practically always spherical and brilliant in appearance. The term applies to all such inclusions larger than 1/32" in diameter. The term small bubbles (commonly known as boil) refers to sizes between 1/32" and 3/32".

SEEDS—Minute bubbles less than 1/32" in diameter. Fine seeds are visible only on close inspection, usually appearing as small specks and are an inherent defect in the best quality of plate glass.

Seed about 1/64" to 1/32" in diameter are usually considered as coarse seed.

HEAVY SEED—Refers to condition when the fine and coarse seed are very numerous such as twenty-five or more to the square inch.

SCATTERED SEED—Indicates a condition of few and occasional easily visible coarse seed. Two or three may be spaced one or two inches from each other, but one here and there at much greater distances apart is the usual intention of the term.

OPEN BUBBLES—Bubbles which have been broken into by grinding, leaving a hemispherical hole in the glass surface.

BLISTERS—Elongated bubbles or seeds, elliptical in shape. This form of bubble is generally peculiar to window glass, but may be found in plate glass manufactured by recently improved methods. In both cases the method of manufacture draws out practically all bubbles in one direction.

SKIM—Streaks of dense seed with accompanying small bubbles.

STRINGS—Wavy, transparent lines appearing as though a thread of glass had been incorporated into the sheet.

CORDS—Heavy strings incorporated in the sheet, occurring without any regularity of direction, and appearing to be of considerable thickness rather than on the surface.

REAM—An area of unhomogeneous glass incorporated in the sheet producing a wavy appearance.

SCRATCHES—Any marking or tearing of the surface appearing as though it had been done by either a sharp or rough instrument. Scratches occur on sheet glass in all degrees from various accidental causes.

SHORT FINISH—Insufficient polish or lack of brilliancy; improperly finished surface which has the appearance of being slightly pitted and wavy when the surface is viewed in reflected light. These indentations, which are slight, have a polished rather than a ground surface, but the general effect is a slight dulling of the surface. Poor polish is usually caused by improper grinding.

STONES—Any opaque or partially melted particle of rock, clay or batch ingredient imbedded in the glass.

LINES—Waves which extend continuously across the sheet so that the reflection from the surface appears as a line or series of lines extending either the full width or a considerable distance across the sheet.

BURNS—Small projections or indentations on the surface appearing as an area of small specks together with some destruction of the surface polish. An imperfection occurring during the flattening of window glass caused by flattening furnaces becoming too hot.

FIRE CRACKS—Small cracks penetrating the surface of the sheet. Usually in the shape of short hooked crescents. Caused by sudden heating or chilling of the surface.

SAND HOLES—Rough spots on the polished surface produced during coarse grinding which fine grinding did not later remove; due, to some extent, to coarse grains of grinding sand becoming mixed with finer grades.

CENTRAL AREA OF SHEET—This term is used with slightly different interpretation with reference to plate or window glass. In plate glass the central area is considered to form an oval or circle centered on the sheet whose axes or diameters do not exceed 80% of the over-all dimension. This allows a fairly large area at the corners which may have imperfections not allowed in the central area.

In window glass the central area is considered as being a circle having a diameter equal to half the width of the sheet or an ellipse having one diameter equal to half the length of the sheet and the other diameter equal to half the width of the sheet.

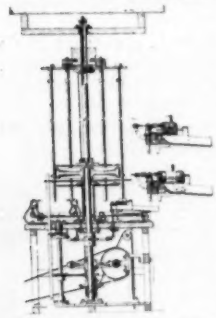
Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Copies of United States Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

Machine for Making Glass Articles. U. S. 1,493,044. May 6, 1924. Gustave A. Leiman, of New York, N. Y.

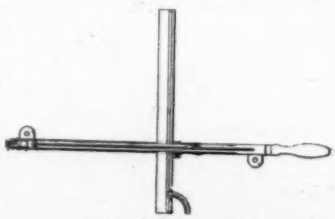
This invention relates to a machine for making glass articles, such as beads, buttons and the like, from canes, rods or sticks of glass, and has for its object to provide a machine which is constructed to automatically control the progressive operations through which the material for making the articles is passed and also to provide a machine which will be simple, durable and effective.



The inventor claims a machine comprising a vertically movable carrier for a plurality of heated glass canes, molds having members adapted to move toward and away from the canes, and means for reciprocating said members to form and cut the articles from the canes.

Cutting Device for Glass and Other Articles. U. S. 1,495,523. May 27, 1924. Clifton R. McLean, of Stoughton, Mass.

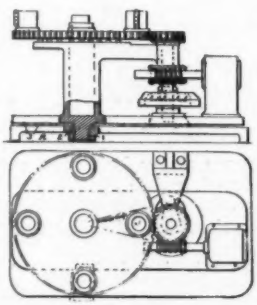
This invention relates to improvements in devices for cutting glass and other articles and the principal object thereof is to provide a device comprising cutting instrumentalities adapted to engage and score opposite faces of the article to be cut.



The inventor's claims cover a glass cutting device comprising a frame having a base and an overhanging arm providing a free space between, co-operating cutting instrumentalities mounted in axial alinement in the free ends of the base and overhanging arm, and positioned to engage opposite faces of a plate of glass, a support slidably mounted on the base, a longitudinal flange on a support extending at right angles to the base, a guide pivotally mounted on the support adapted to engage the edge of the plate of glass and a gradual sector concentric with the pivot of the guide adapted to indicate the angular position of the guide relatively to the flange and means for clamping the guide in adjusted positions.

Apparatus for Making Articles of Glass. U. S. 1,494,438. May 20, 1924. William J. Miller, of Swissvale, Pa.

The invention includes apparatus for feeding or supplying of molten glass from a flowing stream or other discharge of glass from a tank to the molds. The objects which the inventor had in view are the increase of production, and the continuous operation of the fabricating mechanism, thus avoiding the necessity for overcoming the inertia in starting and the momentum in stopping.



In carrying out the invention, a mold support or table is employed which, during the operation of the fabricating mechanism, is moved continuously, preferably in a rotary manner, but the speed of said table relative to a fixed point, such, for instance, to the feed orifice, is variant so that the molds lag in the feeding position.

Lens or Cover Glass. U. S. 1,495,521. May 27, 1924. Nicholas Kopp, of Pittsburgh, Pa., assignor to Pittsburgh Lamp, Brass & Glass Co., Pittsburgh, Pa.

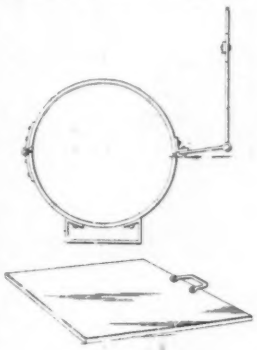
This invention relates to improvements in lenses or cover

glasses for lamps for automobiles, railway cars, etc., and more particularly to a lens or cover glass designed for use on tail lights or lamps used at the rear of automobiles, cars, etc.

The inventor claims a lens or cover glass comprising an integral body having a lenticularly curved central portion, an inner annular step or prism on its rear face, adjacent the central portion, an outer annular step or prism on its rear face, an intermediate annular step or prism on its rear face, said latter prism having its base reversely disposed relatively to the bases of said inner and outer prisms, and an annular prism on the front face and disposed over said intermediate prism on the rear face in such manner that light passing through the intermediate prism will pass through the prism on the front face.

Mold for Glass Cylinders. U. S. 1,494,042. May 13, 1924. William G. Twyman, of Caney, Kans.

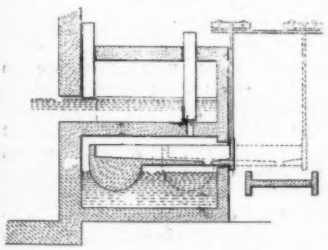
The inventor's purpose is to provide a mold for glass cylinder blowing that is extremely simple of construction, and highly efficient in operation, whereby glass cylinders may be blown of the same diameter that is otherwise impossible, without a mold of the present type.



The inventor's claims cover the mold of the class described, a pair of semi-cylindrical half sections hingedly joined together, means for opening and closing one of the half sections with respect to the other, means for anchoring the other of the half sections to a support, a platform spaced beneath the mold and a removable plate adapted to be positioned between the mold and the platform.

Glass Manufacture. U. S. 1,496,151. June 3, 1924. Elmer Davis, of Okmulgee, Okla.

This invention pertains to the glass working art, and is directed to an apparatus by means of which molten glass may be transferred from the melting tank or furnace to a drawing pot or receptacle, without the interference of several objectional features now common in the art.



The inventor's claims cover an apparatus for the manufacture of glass, a tank for containing molten glass having an enclosed extended end portion formed with a bottom wall provided with a glass discharge port therein; a heating kiln positioned under said extended end portion; a refractory glass receiving trough suspended for reciprocal movement within said kiln and adapted to receive glass from said discharge port, and means for maintaining the temperature of said trough above the glass melting point.

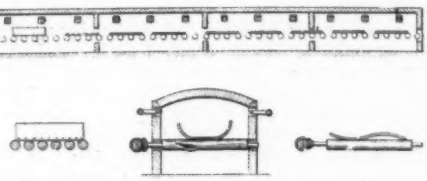
Method of Ornamenting Glassware. U. S. 1,494,630. May 20, 1924. Charles L. Reizenstein, of Pittsburgh, Pa.

An object of this invention is the provision of a method whereby glassware may be easily and relatively cheaply provided with intricate designs of one color and a background of another color.

The patentee claims the method of ornamenting glassware, which consists in coloring a portion of the back thereof, in firing the color, in printing a design on the face of the ware opposite the color, in etching the face of the ware surrounding the design above the color to form a background for the design, in covering the etched portion and design with relatively stiff color material, in removing the color material above the design while leaving that above the etched portion and then in firing the ware.

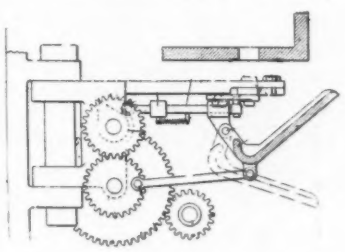
Process of Flattening Glass Sheets. U. S. 1,497,798. June 17, 1924. Harry G. Slingluff, of Mount Vernon, O., assignor to Pittsburgh Plate Glass Co.

This invention covers a process of flattening sheets of glass having polished surfaces and a curvature which it is desired to remove and in which the glass has a temperature below that at which it sets, which consists in moving the sheets continuously ahead in a heated chamber on spaced rotating supports to continuously shift the line of contact between the supports and the sheets, exposing the sheets to a temperature such as to cause them to soften and flatten of their own weight upon the supports but not sufficient to cause any substantial marring of the polished surfaces along the constantly shifting lines of contact with the supports, and then exposing the sheets to progressively decreasing temperatures to permit them to harden and anneal as they move farther along.



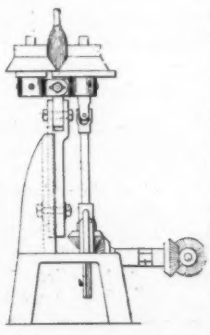
Glass Flowing and Shearing Device. U. S. 1,497,929. June 17, 1924. Edward Miller, of Columbus, O.

This invention covers in a glass flowing and shearing device, the combination with a continuous glass discharging spout, a glass receiving mold, and shearing means including a pair of relatively movable elements positioned beneath said spout, of an engaging trough-shaped spoon having an open and closed end, a pivotally supported end adjacent the closed end and positioned beneath said shearing means upon an axis parallel to the plane including the shearing means, and means connected to said spoon for tilting the same upon its pivot to discharge from the open end of the spoon into the mold in timed relation with the operation of the shearing means.



Glass Working Mechanism. U. S. 1,497,332. June 10, 1924. Noble W. Hartman, of Toledo, O., assignor to General Electric Co.

This invention relates to the working of glass and comprises both certain novel methods of glass working and also novel mechanism for this purpose.



In a previous patent No. 1,408,000, the inventor has described a glass working machine which is adapted for automatic operation efficiently and economically with particular reference to its employment in the production of incandescent lamp bulbs; and while the present invention is described in connection with this machine, the invention is not confined to this machine but can be otherwise carried out and applied, and can be employed, also, in the production of articles other than bulbs for incandescent lamps.

The inventor claims in an apparatus for working glass, the combination with a spindle adapted to carry a gather of glass, means for rotating the said spindle on its longitudinal axis and a marvering member mounted so as to be engaged by the gather of glass and consisting of a disc and a mounting for the same allowing for its free rotation by contact with said gather of glass.

Glass Factory Equipment and Supplies

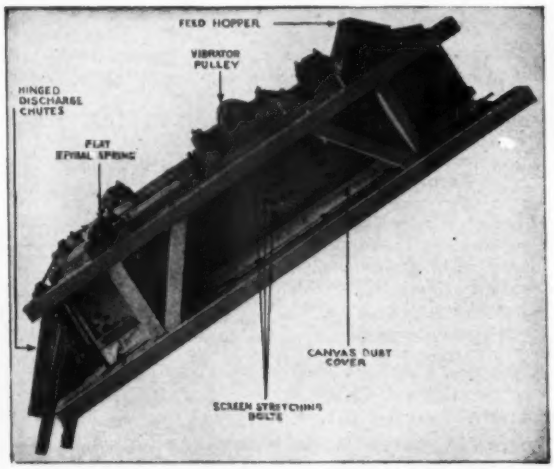
THE GLASS INDUSTRY will be glad to publish descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade. Most of the information printed in this department comes direct from the manufacturers of the products described.

New Link-Belt Vibrating Screen

The necessity for effective and thorough screening of various glass making materials has long been recognized and to meet these requirements a new vibrating screen, novel in principle, has been developed by the Link-Belt Company, of Chicago.

Heretofore agitation of the screen surface has been obtained by a rapid series of rigidly imparted blows, in some cases through mechanical, but preferably electrical devices. It is obvious that this results in lack of uniformity over the screening surface, the vibrations being more intense on those portions of the screen nearest the points of impact of the agitators.

Vibrations of the Link-Belt screen are produced by the action



LINK-BELT VIBRATING SCREEN

of an unbalanced pulley supported on the screening frame and rotated at high speed. The manufacturers claim that every portion of the screen surface is vibrated uniformly, with the result that the entire surface is utilized for its most effective work.

The screen is the invention of Prof. G. A. Overstrom, a brilliant and widely-known mining engineer. Prof. Overstrom was for many years Dean of the Utah College of Mining, and there was brought into intimate contact with the problems of fine ore concentration.

This device, the makers state, effects thorough screening through the finest mesh of any product that can be screened.

Lammert Pressure and Vacuum Pump

The pump illustrated here is a special type duplex, giving vacuum and pressure service simultaneously. It is operated on the rotary principle, the interior construction being shown in the cross-sectional view. This is one of a line of single and double stage, pumps manufactured by Lammert & Mann Company, 217-221 North Wood street, Chicago, Ill., for all high dry vacuum purposes and for pressure service up to 25 pounds. Lammert pumps being of the rotary type are entirely free from valves, pistons, piston rings, connecting rods and other troublesome parts.

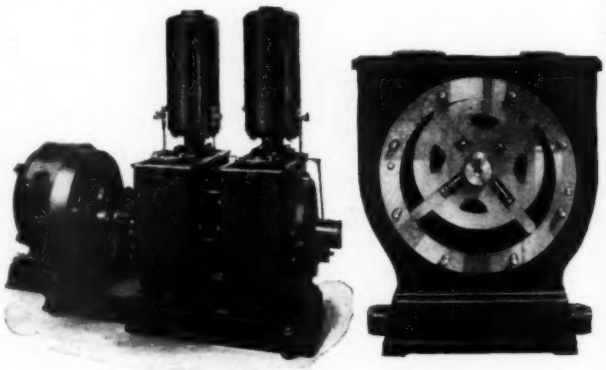
The rotor, as illustrated, is set eccentric to the main bore of the pump. Four sliding vanes or impellers are positively actuated by the rotation of the rotor and by push rods extending through the shaft. These vanes are in contact with the case throughout each revolution. Each of the four vanes as they pass the inlet entrap a volume of air, pushing it around the case to the outlet and forcing it into the exhaust or delivery line.

This feature, it is claimed, maintains a uniform vacuum or pressure at all speeds without pulsation.

Each vane is equipped with an automatic take-up feature for wear, and operates against a coil spring cushion for quiet operation and the elimination of chatter.

Capillary or sight feed oiling devices lubricate all moving parts and form a seal between the rotor, vanes and pump case.

The single stage water-cooled pump for 27½-inch vacuum is



LAMMERT DUPLEX PUMP AND ROTOR

made in 11 sizes with capacities ranging from 3½ cu. ft. to 700 cu. ft. per minute. The double stage water cooled pump, for vacuum within ½-inch of barometer, is made in four sizes ranging in capacity from 3½ to 90 cu. ft. per minute.

The single stage air-cooled pump is made in four sizes, with capacities of from 3½ to 24½ cu. ft. per minute.

Valuable Book on Practical Pyrometry

Believing that enough thermo-electric pyrometers are in use to warrant a special publication on their installation and care, The Brown Instrument Company, of Philadelphia, has recently published a 72-page book covering this subject thoroughly. It is entitled "Instructions for Installation and Care of Thermo-Electric Pyrometers." There is hardly a man who works with pyrometers who does not at sometime desire information regarding protecting tubes for thermocouples, and various methods of wiring indicators and recorders, methods of eliminating cold junction errors, methods of installing couples, and of checking thermocouples, wiring, or the accuracy of the instruments. These subjects are gone into from the practical and theoretical angles, as well as such other subjects as open and conduit wiring, mounting the instruments, locating defects in the thermo-electric circuit by various means, and many other points which will be of immense interest to the man who has to work with the equipment from day to day. This book also contains temperature millivolt equivalents for thermocouples and conversion of Fahrenheit and Centigrade scales. The Brown Instrument Company send it free to users of pyrometers.

Refractories Directory and Book of Brands

The fifth edition of the Refractories Manufacturers Association's "Book of Brands" is about ready for distribution. This 48-page booklet gives, in addition to a complete list of manufacturers of fire brick in this country and in Canada, an alphabetical list of the brands and trademarks used in the industry. The manufacturers' names are grouped by states, which makes it a convenient reference book. Copies may be obtained without charge by application made to Frederic W. Donahoe, Secretary, 2202 Oliver Building, Pittsburgh, Pa.

The Glass World and What It Is Doing

News of the Industry

National Physical Laboratory Report

The annual report covering the year 1922 of the National Physical Laboratory, Teddington, England, was recently issued. It describes in detail the activities of the organization which functions for Great Britain in a somewhat similar way to that of the Bureau of Standards at Washington, for this country. In the glass field it not only conducts its own investigations and experiments, but also co-operates with other research organizations.

A large amount of work has been carried out for the Glass Research Association. This concerns the measurement of the viscosity of various kinds of glass over a wide range of temperature, and to a number of allied problems which have arisen in connection with the preparation of glass for this purpose. Several reports of the results of viscosity determinations have been submitted to the Research Association and have been published by them in the confidential bulletin circulated to their members. In connection with this work a large number of glass analyses have been carried out in the Chemical Division.

The problem of establishing a satisfactory method of determining the "thermal endurance" of any given kind of glass has been carefully studied, and a report, partly mathematical in character, has been submitted to the Glass Research Association. The conclusions indicate that a satisfactory "absolute" test for thermal endurance is not at present possible, and that empirical tests, the relative results of which are *not* entirely independent of the particular conditions of the test, must still be employed. Steps in the direction of standardizing several empirical tests of this kind are in progress.

OPTICAL GLASS RESEARCH.—Work on this subject has been devoted mainly to the improvement of the equipment required for the various experimental operations connected with glass melting, and to the study of methods of determining the viscosity of glass, particularly at high temperatures. The latter part of the work has gone hand in hand with the work on viscosity determination carried out for the Glass Research Association. In regard to plant and equipment a new recuperative gas-fired melting furnace has been constructed. Considerable trouble has been experienced with the furnace previously erected, and an entirely new construction, closely resembling the very successful recuperative kiln already in use in the Department, has been adopted. This has now been tried for a number of meltings and has proved eminently satisfactory. For the purpose of some of the experiments a larger size of melting pot has become necessary. Pots purchased for this purpose have proved quite unsatisfactory, being too weak and insufficiently resistant. It has therefore been necessary to increase the size of the apparatus available for pressure-casting of pots, and this has now been successfully completed, and pots of the larger size have been successfully cast. For the purpose of viscosity measurements, glass in the form of rods is required. In order to obtain this from small scale meltings, such as can be carried out in the Laboratory, a special rod-drawing appliance has been designed with the assistance of R. L. Frink, Director of Research of the Glass Research Association. This apparatus consists of the usual type of water-cooled vessel or jacket through which the glass is drawn at such a rate as to become chilled in the desired shape. Usually such vessels are made of steel or iron. Through the courtesy of Dr. R. Seligman, of the Aluminum Plant and Vessel Company, an apparatus has been constructed in which a vessel consisting of aluminum is employed. This has proved extremely satisfactory, and appears to offer many advantages for work of this kind. These advantages are a considerable saving in weight of the whole apparatus, greater thermal conductivity, which results in a lower temperature of the walls of the vessel when exposed to radiation from the glass or furnace, and a complete immunity from injurious scale of droppings, which in the case of iron vesesls may at times cause discoloration of the glass. Thus the use of aluminum vessels for this purpose appears to be so great that its adoption in industrial installations would be advantageous.

Some further work has been done on the use of special refractories for resisting more completely the attack of molten glass. Several methods of using pure fused zirconia in the manufacture of crucibles for glass-melting have been tried, but entirely satisfactory results have not yet been obtained.

Some Comments on the Sample Fair of the North Bohemian Glass Industry

Notwithstanding the severe business crisis which the entire industry experiences, the creative power of the industrial inhabitants does not flag. On the contrary it looks as if they want to stimulate the inclination to buy and to revive sale by offering first-rate goods.

These efforts can be felt in the glass industry, even perhaps more than elsewhere, as many of its products are articles of luxury and have to find friends interested in art and beauty of shape. And truly one can speak of art and beauty of shape with regard to the products of the Bohemian glass industry. Look only at the splendid fancy glasses of the Haida-Steinschoenau hollow ware or at the glass ware for lighting purposes. While some decades ago the designs came from abroad and work was often done only after copies, we now see original designs and artistically well weighed ones, which compete with the products of renowned foreign firms.

A new creative genius, a new life is throbbing in the veins of the industrial people in defiance of the economic crisis. All technical attainments are adapted and turned to account and readily the artist's leading voice is listened to, usually showing new ways and paths. Only so it was possible that notwithstanding the economic crisis new standard works were again created, confirming anew the fame of the North Bohemian glass industry.

Especially rich are the collections of crystal glasses with deep cut decorations. Here the refinement of taste extends to the smallest workshops and in praise of our glasscutters we must say that they pride themselves on producing true works of art in the cutting technic. It is really a pleasure to admire all those beautiful vases, cups and bric-à-brac made of crystal clear as water and adorned by artistic cutting which are displayed in the sample show rooms.

With regard to the hollow ware line, it concerns itself with the application of new decoration technics which show up wonderfully on the partly cased and etched glass. One likes again to show off the painting in its pure artistic effect as just here a vast sphere of action opens to our North-Bohemian artists. Plant ornaments framed with beautifully executed etched border-decoration play here likewise an important part to mount befittingly the specially qualified hand-painting. Besides charming gold and silver line edgings, tastefully combined enamel filling-ornaments are used by which the many colored fashion-character of our day is complied with.

The new samples of the glass industry at the present period are ruled by the decoration technic. Surely one tries at the same time to voice the style of the forms in a special way. But on the whole the main object is a fit and well adapted effect of the decorations.

The material and special division of the groups of goods in household, fancy and ornamental glass was perhaps never clearer and stricter than now. Cleverly the form is adapted to answer the purpose and today when approaching the showrooms of any sample fair, a hasty glance already will convince us of the kind of work we have before us. But not only

with fine crystal, cut glass and hollow ware the strict division in groups and grades of value has been effected. In the small glass ware, too, one tries to combine sets, the better to illustrate all improvements. A special branch of the North Bohemian glass industry is amongst others the manufacturing of glass ware for lighting purposes. This branch of our industry was crowned with a full success, as even the rival firms abroad had to acknowledge. True that during the war this branch suffered a passing disturbance of its development, as to a large part its hands had to leave the workshops and to join the army. But it seems that in the great majority these trained hands have returned to their work and their new creations promise us great surprises in new forms of suspensions, ceiling-lighting and small lighting requisites for the household. With these things, too, decoration plays to-day an important part and especially one tries to obtain fine effects by the use of iridescent, lustre and marbled hues. Splendid subjects were brought in silhouette decorations which last year were predicted to go off but weakly and yet have met with adequate appreciation. By the alternate use of opaque and transparent colors it is also possible to take into account the reflecting effect of the light and to improve the decorative impression. Among other things we have also to welcome the attempts of displaying the glass technic on specially suitable reliefs.

Considering the entire work of the North Bohemian glass industry within narrow bounds, we come to the conclusion that the industrial district of Haida-Steinschönau as well as that of Gablonz have produced new standard creations which will be a credit to them. Let us hope that the efforts of the manufacturers to produce standard goods will be crowned with some success, for the creations displayed by these industrial districts at the fairs are well worthy to meet with a ready sale. —*Allegemeine Glas-und Keram-Industry.*

Summer Trip of American Ceramic Society

The trip to the Pacific Coast planned for members of the American Ceramic Society will begin on July 21 and be concluded about August 19. Idaho, Washington, Oregon, California and Colorado will be visited.

The ceramists of the Western States, in the Rockies and on the Pacific Coast, are unanimous in their invitation to all who will accept this opportunity to visit them. They want the members to see their factories and to see the natural wonders with which Nature so abundantly and with such a variety has favored them.

Included in the itinerary are Mt. Rainier National Park, Yosemite National Park, the Grand Canyon, Pike's Peak and other world wonders.

Numerous invitations to members to visit manufacturing plants have been received from manufacturers of common brick, fire brick, terra cotta, china and porcelain ware, pottery, refractories, enameled metals and other products. Clay and coal producers will extend a welcome to their mines. H. S. Thatcher, general manager of the Celite Products Company, manufacturers of Sil-O-Cel heat insulating brick invites visitors to inspect the Company's mineral deposits and their brick plant and laboratory at Lompoc, Cal. At the Illinois-Pacific Glass Company, San Francisco, Cal., visitors may see an electric annealing furnace which A. L. Gladding, secretary of the Society's San Francisco committee, says he understands is the only one in the world operating successfully.

Proves Value of Glass Containers for Protecting Hard Candy from Deterioration

A study of the effect of the exposure of hard candy to varying degrees of humidity and temperature has been made by the Research Laboratories of the Glass Container Association. A report of the investigation by S. Henry Ayres and L. A. Palmer is published in the May, 1924 issue of *The Glass Container.*

In making the experiments methods were selected which would prove definite conditions which could be varied at will.

The effect of humidity on hard candy is a matter of practical importance since it means that even when air has a low humidity, constant exposure of hard candy to it will bring about visible changes which affect its marketability.

In the tests under discussion, the time in which visible changes were produced by more or less definite quantities of absorbed moisture varied in an inverse proportion to the humidity. With a humidity of 90 per cent the change may come to two hours' exposure while at 65 per cent relative humidity six hours' exposure was required to bring about the same change in appearance. When the finish was changed by moisture it never returned to the original finish upon drying.

The results clearly show that hard candy must be protected from the influence of atmospheric moisture if it is to be kept in its original attractive condition. The absorption of a very small amount of moisture destroys the lustre and causes a dull appearance and the candy becomes sticky. When the humidity is high these changes come rapidly, when low, they are delayed. In order to keep hard candy in its original condition it should be packed in moisture proof air-tight containers.

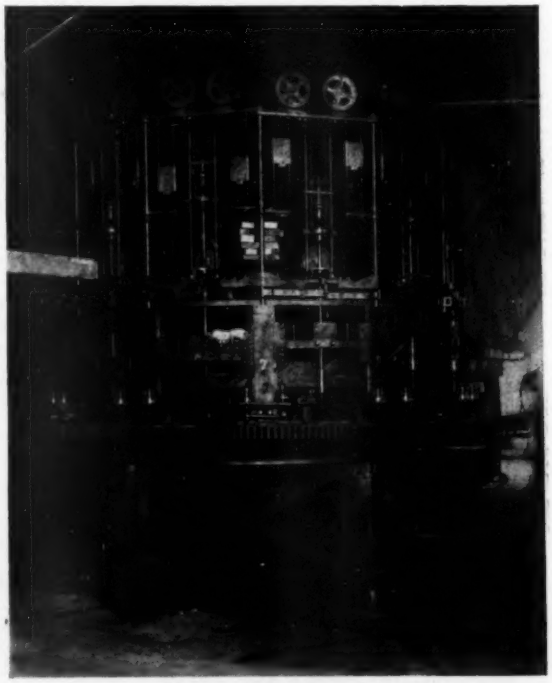
For this purpose glass jars with screw caps and liners have proved to be excellent containers, since they permit the display of the attractiveness of the candy and at the same time protect its quality.

The Glass Container Association believes that the work done in this investigation will mean an extension of the use of glass containers in the confectionery field and will be of vital importance to every glass manufacturer in the country.

Automatic Insulator Press at Lynchburg

A machine of the Brookfield type with improvements developed by the owners for making glass insulators automatically has been installed in the factory of the Lynchburg Glass Corporation, at Lynchburg, Virginia.

The mammoth machine, illustrated here, takes glass in



AUTOMATIC INSULATOR PRESS

the molten state from the furnace, cuts off a gob of the proper size, presses it automatically and deposits the finished insulator on a conveyor which takes it into the annealing lehr.

According to J. William Gayner, vice-president and general manager of the Lynchburg company the machine embodies the experience of three generations of the Brookfield family in the manufacture of insulators.

At the Lynchburg factory a full line of insulators of all types now in use is made and shipped to all sections of the United

States and to numerous foreign countries. By means of this machine, the owners expect to be able to compete with the Germans for the South American trade. They are opening agencies in Cuba, Mexico and South America for the sale of their product.

Largest Plate of Glass

Pilkington Bros., Ltd., with factories at St. Helens, England, and Thorold, Canada, have on exhibition at the British Empire Exposition, Wembley, England, what is said to be the largest sheet of plate glass ever made in England, measuring 14 by 24 feet, with a total area of 336 square feet.

Window Glass Price Guarantee

The American Window Glass Company notified the trade that from June 2 it would guarantee prices only against its own decline to date of shipment, this taking the place of their previous guarantee which expired June 1.

Industrial Publications

Archibald Harris & Company, well known certified public accountants, 517 Marquette Building, Chicago, Ill., have issued a digest of the changes resulting from the new 1924 laws affecting income, gift, estate, and miscellaneous taxes. The digest gives in concise form a great deal of information needed by corporations and individuals when keeping records and preparing tax reports. Copies of the digest may be obtained from the publishers of it at the address given above.

Simplex Engineering Co., Washington, Pa., have ready for distribution a new 12-page pamphlet describing the Simplex Patented Flat Arch Muffle Lehr. The advantages of using flat arches are pointed out and the design and construction of the lehr are briefly described. Illustrations make clear the principal details. A feature of this lehr is the use of carbofrax tile in combination with fire clay tile. Carbofrax tile has seven times greater thermal conductivity than the fire clay tile and the manner in which it is employed is said to reduce the fuel consumption of the lehr 20 per cent.

The Engineering Department of The Austin Company, Cleveland, O., has issued an interesting pamphlet discussing the relative advantages and disadvantages of multistory and single story buildings for factory purposes. The company builds both kinds but comparative studies made of many buildings of both types led to the irresistible conclusion that in all except very few instances the single story building is the best from both the production and investment points of view. When full consideration is given to the larger amount of non-productive space occupied in multistoried buildings by columns, outside walls, approaches, stairways and elevators, and a comparison made of the fixed charges and operating costs of the two types, together with the land value factor, the conclusion is almost invariably in favor of the single story structure.

Copies of the pamphlet may be obtained from the company's headquarters at Cleveland.

Quigley Furnace Specialties Company, 25 Dey Street, New York have just issued a pamphlet entitled "Hytempite in the Power Plant."

This bulletin illustrates and describes some of the many successful applications of Hytempite in refractory construction and maintenance. It tells why thin joints are recognized as correct practice in fire brick masonry and why a cemented joint is far superior to fire clay.

The use of crushed old fire brick for patching and rebuilding furnace walls, making monolithic baffles and special tile, is described and illustrated in considerable detail, giving tables of the correct mixtures, together with methods of application. Special stress is laid on mixing of the ingredients and application, on which depends the successful use of granular refractories.

Hytempite is a dense, plastic refractory material, scientifically compounded, for bonding fire brick and for kindred uses. It forms a lasting union between materials joined, air sets at normal room temperatures and retains its strength up to temperatures at which the best quality of fire brick will become soft.

It can be used as a binder wherever fire clay brick, silica brick, tile or granular refractories are used.

Verified News of Trade Activities

Pacific Coast Glass Company has been incorporated at Wilmington, Del., with a capital of $2,500,000, to manufacture all kinds of glassware.

The Westchester Glass Company, New Rochelle, N. Y., has been incorporated with a capital of $10,000 by J. Talbot, W. Nicolai and L. McQuillan.

The plant and property of the **Paramount Window Glass Company,** Clarksburg, W. Va., was sold on May 24 to George H. Trainer of Salem, W. Va., at a bid of $20,000.

The Indiana Glass Company, Dunkirk, Ind., glassware manufacturers, are erecting a lehr building 88 x 110 ft. at a cost of $20,000, instead of $40,000 as announced in recent press reports.

The Simplex Engineering Company, Washington, Pa., have been awarded a contract for installing a group of Fourcault machines in the plant of the **Western Sheet Glass Company,** Torrance, Cal.

The Hart Glass Manufacturing Company, Dunkirk, Ind., is making new additions to its plant, and is erecting a new warehouse 500 ft. by 100 ft. Two new continuous tanks have also been installed.

The Dura Glass Corporation, New York, has been incorporated with a capital of $20,000, by R. I. and B. D. Ratner, and D. Sydney. C. L. Raskin, 233 Broadway, New York, is attorney for the company.

The Armstrong Cork & Insulation Company, Pittsburgh, Pa., announces changes in addresses of its branch offices at Denver, Colo., to 720-21 Symes Building, and at Kansas City, Mo., to 410 West Sixth Street.

William J. Miller, Swissvale, Pa., manufacturer of automatic glass-working machinery, is distributing to the trade a novel metal souvenir which comprises an envelop-opener, 5-inch rule, and magnifying glass all in one article.

J. C. Gipe has severed his connection as superintendent of the **American Plate Glass Company,** Kane, Pa., and it is understood that he has accepted an important position in connection with the proposed new Libbey-Owens development at Toledo.

The Corning Fibre Box Company, Corning, N. Y., has had plans prepared for the construction of a new one story addition to its plants, 100 x 120 ft., with improvements to the present plant, estimated to cost $50,000. A. M. Tietzel is the company's architect.

Amour Loriaux, vice-president and treasurer of the **Connelly Glass Company,** manufacturers of window glass, etc., Caney, Kans., reports that no definite decision has been reached regarding the rebuilding of their plant which was recently destroyed by fire.

The plant of the **Modern Glass Company** at Toledo, O., was recently sold to James Austin, Jr., special trustee for the organized stockholders, for $150,000, of which $75,000 was paid in cash. The plant will be used by the Kaufman Metal Products Company.

Standard American Glass Company, Los Angeles, Cal., has been incorporated with a capital of $1,000,000, to operate a local sheet glass plant. Incorporators: F. A., H. P. and W. L. Dixon. Representative: Glen Behymer, 1215 March-Strong Building, Los Angeles, Cal.

The hot glass department, mold shop and cutting departments of the **Imperial Glass Company,** Bellaire, O., closed on June 28 for two or three weeks, during which time necessary repairs will be made. The shipping department and office will continue uninterruptedly.

The Carr-Lowrey Glass Company, Baltimore, Md., manufacturers of bottles and hollowware, has taken title to a tract of property adjoining its works, at cost of $55,000. The com-

pany report that they have no intention or plans under way to improve the property at the present time.

Harry M. Mabey, of New York, was recently elected chairman of the Traffic Manager's Council of the Associated Industries of New York State. Mr. Mabey is General Traffic Manager of The Mathieson Alkali Works, Inc., New York, having directed their traffic department for several years.

La Cie Gauthier & Frere, Inc., Quebec, which has been in business there for the past fifty-five years, has been taken over by an organization controlled by **La Cie Creamo-Vitrail, Incorporated,** Montreal, headed by Isadore Crepeau. The new organization, capitalized at $200,000, will continue the business.

Ray S. Godard, construction engineer of the Illinois Glass Company, Alton, Ill., resigned his position on July 1 and will enter a new line of business about September 1. Mr. Godard had been with the Illinois Glass Company approximately fourteen years, designing and looking after construction work at their various plants.

After efforts to avoid a receivership the **Davies Glass and Manufacturing Company,** Martins Ferry, O., which had been facing difficulties for some time, filed a voluntary petition in bankruptcy in the United States District Court at Columbus, O. The liabilities of the company were roughly estimated at $135,000 and the assets placed at $45,000.

The Hubert Art Glass Company, recently organized to take over and expand the Bridgeport Art Glass Company, will occupy three buildings at 253-271 John street, to be devoted to the production of art glass windows, plate and window glass of all kinds, copper store fronts and other products, with departments for beveling and polishing.

Samuel Krantz, said to have been connected with the Armor Plate and Non-Shatterable Glass Corporation, New York, and against whom an injunction had been issued by the Supreme Court preventing him from selling stock of the company, was arrested recently charged with obtaining $13,500 from Mrs. Edith M. Cook of Bristol, Conn., for stock alleged to be worth less than was represented.

The Austin Company, Cleveland, O., engineers and builders, announce the removal of their Chicago headquarters to Suite 1300, Burnham Building. The company has several million feet of floor space under construction, a goodly portion of which is in Chicago territory. Increased facilities in the new location will make it possible to render their complete building service to a larger number of clients.

The Illinois Glass Company, Alton, Ill., announces the opening on July 1 of a new corrugated fibre box plant in connecton with their new glass bottle factory at Bridgeton, N. J., which will enable them to give the east the same high grade package service which the west has enjoyed for past years. The new plant will furnish boxes or other corrugated fibre products either in connection with glass or separately.

O. B. Cline, president of the **Window Glass Cutters' League of America,** announced on June 6, that the scale on single strength window glass has been advanced from 44 cents to 46.8 cents per 100 foot box. The increase dates back to January 1, 1924. The Blackford Window Glass Company, Vincennes, Ind., of which Frank Bastin is president, and which recently started operations with Fourcault machines, has signed the League's scale.

The Puget Sound Glass Company, Anacortes, Wash., who recently completed remodelling their plant, are installing O'Neill automatic machines Nos. 28 and 30, with O'Neill feeders, made by the O'Neill Machine Company. The company will manufacture flint bottles and jars, running entirely automatic and will use Belgium sand. The officers of the company are: George W. Krebs, president; V. Funk, secretary; J. O. Jensen, general manager, and William Randolph, sales manager.

The Automatic Glass Products Company, 339 Nicholas Building, Toledo, O., has been organized to manufacture tumblers, stemware, electric bulbs and thermos bottles, production of which has already commenced in a factory recently acquired at Wellsburg, W. Va. The officers of the new corporation are: Leonard J. Ulrich, president; Carl A. Goodman, vice-president and treasurer; B. C. Gilligan, secretary; A. B. Armstrong, general manager; Walter L. Ulrich, mechanical engineer and counsel, Richard D. Logan.

Hazel-Atlas Glass Company, Wheeling, W. Va., announce the appointment of J. H. McNash, formerly secretary, as executive vice-president and manager to fill the vacancy caused by the recent death of George G. Oliver. A. M. Algeo, superintendent of Hazel No. 1 plant at Washington, Pa., has been appointed district manager of the company's Pennsylvania plants. H. S. Brady, in charge of the Wheeling plant has been appointed district manager of the West Virginia plants and S. B. Bowman has been named district manager for the plants in Ohio and Oklahoma.

The Miller Machine and Mold Works, manufacturers of glass house machinery, 705-719 Ann St., Columbus, O., have given their sales agency for the British Isles to the **British-Hartford-Fairmont Syndicate,** 142-143 Audrey House, Ely Place, London. The Miller Company reports foreign business good so far this year. They have recently made the following shipments: Christalerias Rigolleau, Buenos Aires, one combination machine; Societa Vetraria dell 'Italia Centrale, Rome, Italy, one tumbler press; and have an order for two tumbler presses for a new glass plant now in the course of construction in Germany.

The Porter Mirror & Glass Company, manufacturers and importers of plate glass and French mirror plates, also a complete line of glass store fixtures and ornamental art glass, Shelbyville, Ind., is erecting another branch factory in the Central Manufacturing District of Los Angeles, Cal., in addition to the one already in operation at Fort Smith, Ark. It is expected that the new building, which will be one-story, 80 ft. wide and 230 ft. long, will be completed and ready for the installation of new machinery by July 15th. William W. Porter, who has been directing the plant at Fort Smith, will take over the management of the new factory.

Subscriptions are being taken for the preferred stock, of the **Scohy Sheet Glass Company,** Sistersville, W. Va., organized with a capital of 10,300 shares of common stock no par value, and $150,000 of preferred stock of $25 par, carrying provision for dividends at the rate of 8 per cent. The Fourcault process of machine glass manufacture will be used. It is intended to consolidate the plants of the John B. Scohy Glass Co. and the Independent Glass Co. John B. Scohy, well known window glass man, is president of the new company and will have complete charge. August Raspillaire is vice-president, Emile Lambiotte, treasurer, and Nestor R. Scohy, secretary. The work will be let out on a definite contract for the entire construction.

August Staudt of the Perth Amboy Tile Works, Perth Amboy, N. J., has been appointed by the board of trustees of the American Ceramic Society as vice-president of the Society in succession to the late Raymond M. Howe. Mr. Staudt was born in Nuremberg, Bavaria, on December 6, 1869, receiving his education in that country. From 1891 to 1896 he spent the years in England, France and America perfecting his training as a correspondent in foreign languages and in 1896 returned to Nuremberg, where he became connected with a large local industry as superintendent. In 1901, he returned to this country and became associated as manager with the Perth Amboy Tile Works, which he has built up from a small tile factory to a successful enterprise. Mr. Staudt has been a member of the American Ceramic Society since 1911 and is a past president of the New Jersey Clay Workers' Association and Eastern Section of the American Ceramic Society.

Recent Deaths

G. Grant Oliver

G. Grant Oliver, vice-president and general manager of the Hazel-Atlas Glass Company, Wheeling, W. Va., died on June 5, after several weeks' illness from pneumonia and complications. Mr. Oliver was born near Conneautville, Pa., in August, 1866. In 1888 he graduated from the Washington and Jefferson College, shortly after which he became associated with the Hazel Glass interests at Washington, Pa. He was familiar with all branches of the industry and until illness interfered was in charge of operations at the several

factories of the present company located at Wheeling, Washington, Clarksburg, W. Va., Zanesville, O., and Blackwell, Okla.

Henry S. McKee

Henry Sellers McKee, a retired glass manufacturer, died on June 10 at the Atlantic City Hospital following an operation. Mr. McKee, who was 84 years old at the time of his death, entered the glass business in Pittsburgh in the sixties, joining his brother, Frederick, in a flint glass factory which was then known as F. & W. McKee and later as McKee & Brothers. Mr. McKee was also founder of the Chambers & McKee Glass Company, manufacturers of window glass, and in 1890 he was the first American glass manufacturer to introduce from abroad the Siemens process which supplanted the old pot systems with the present tanks and regenerative furnaces. He later established a producing centre outside of Pittsburgh, which became the present town of Jeannette, Pa., Mr. McKee naming it after his wife. The firm of Chambers & McKee sold out to the American Window Glass Company in 1900. Mr. McKee was also actively interested in street railway electrification in various cities. He is survived by his wife and two sons.

Coming Meetings

The annual meeting of the **National Glass Distributors' Association** will be held in Pittsburgh, Pa., during December, 1924.

The Summer meeting of the **American Ceramic Society** will take the form of a four weeks' trip to the Pacific Coast, leaving Chicago on July 21 and returning about August 19.

The annual meeting of the **National Ornamental Glass Manufacturers' Association** of the United States and Canada will be held at New York, July 7 and 8.

The **American Association of Flint and Lime Glass Manufacturers** will hold their annual meeting at the Marlborough-Blenheim Hotel, Atlantic City, N. J., on July 14. The **National Association of Manufacturers of Pressed and Blown Glassware** will meet at the same place on July 15 and on the 16th will meet a committee of the **American Flint Glass Workers' Union,** whose convention began on June 30, in a joint conference to consider the wage scales in the various branches of the industry for the ensuing year.

The Atlantic City convention of the **Glass Bottle Blowers' Association** of the United States and Canada will begin on July 7.

What the World Wants

Specific inquiries for American goods received in the Department of Commerce.

Numbers prefixed to the items refer to confidential information which may be obtained by concerns listed in the Exporters' Index by applying to the nearest district office of the Bureau of Foreign and Domestic Commerce, or to headquarters at Washington, D. C. Mention the number of the inquiry in which you are interested.

To become listed on the Exporters' Index, it is necessary to fill out a form (Form 57), which may be had upon application to the Bureau or its district or co-operative offices.

The asterisk (*) indicates that the inquirer would act both as purchaser and agent.

France. 10486, industrial chemicals.

Germany. 10485, heavy chemicals; 10524, heavy chemicals; 10762, oxide of lead, red, especially crystal glass oxide.

Australia. 10481, glassware.

Brazil. 10490, chemicals, especially for ceramic industry.

Austria. 10613, crystal and pressed glass dishes, vases, etc.

Colombia. 10593, glass jars, 50,000 ½ lb., for butter.

South Africa. *10614, glass jars, large range of sizes, for displaying confectionery.

Chile. 10784, soda ash.

Haiti. 10804, blown drinking glasses.

Italy. *10817, soda nitrate.

New Zealand. Glassware, such as bottles, tableware and kitchenware.

Inquiries Received

204. Will you kindly give us the names of three or four of the largest manufacturers in the East of cheap table glassware. (May 22.)

205. Who can make a few wired glass cylinders, of 9¾ in. diameter, by 4⅞ in. deep by 7/16 in. thick; ground at both ends. Wire about 1 in. mesh. (May 25.)

207. Would appreciate names of glass factories making domes or globes used by truck farmers for covering early spring plants to protect against frost. (May 28.)

208. We are interested in securing the names of manufacturers of jars similar to the Aridor. (June 18.)

209. (From England.) We are interested in importing glassware of all descriptions, including table and pressed ware, lighting glass ware and bottles and sheet glass. (June 12.)

Correction

The statement made in our June issue that Marshall Field, John H. Fulton, Chas. V. Rich and Edw. P. Currier had been elected to the board of directors of the Libbey-Owens Sheet Glass Company was incorrect. These gentlemen were recently elected to the board of the Owens Bottle Company, which has no connection with the Libbey-Owens concern.

Stock Quotations

(Reported by Moore, Leonard & Lynch, Frick Bldg., Pittsburgh, Pa.)

PITTSBURGH STOCK EXCHANGE, JUNE 24, 1924.

	Bid	Ask	Last
American Window Glass Machine, common	88	89	88½
American Window Glass Machine, preferred	92	93	93
American Window Glass, preferred	109	110	110
Pittsburgh Plate Glass	231	240	235
U. S. Glass	...	22	20
Standard Plate Glass, common	31	...	32⅞
Standard Plate Glass, preferred:			
Cumulative	87½	90	90
Prior	99	100	100

Glass business is only in fair volume, and is not sufficient to keep factories operating at the heavy schedules prevalent earlier in the year. Production is kept in line with consumption, dismissing the likelihood of any accumulation of stocks. Production of all kinds of glass, excepting plate, was curtailed, more than one-third during May and June to 35 per cent of potential capacity. Indicative of this was the decline in the value of contracts awarded for new construction in New York City where one-third of the construction activity of the U. S. has been centered. May awards in this city were fully 57 per cent under those for April 1924. Glassware factories are anticipating a shut-down in July to repair equipment in expectation of capacity operations after August 1st.

WHEELING STOCK EXCHANGE, JUNE 24, 1924.

	Bid	Ask	Last
Hazel-Atlas	30	31½	31
Imperial Glass	...	90	90
Fostoria	140	150	150
Central Glass	...	110	110

The Wheeling issues receded slightly from their recent price levels during the last month. Considerable activity developed in Hazel Atlas, which sold down to 30 on considerable volume, but recovered to 33, closing at a net loss of 2 points for the month.

TOLEDO STOCK EXCHANGE, JUNE 24, 1924.

	Bid	Ask	Last
Owens Bottle Machine, common	42	42¼	41⅞
Libbey-Owens Sheet Glass, common	90	94	92
Libbey-Owens Sheet Glass, preferred	108	111	110

Current Prices of Glass-Making Materials

Quotations furnished by various producers, manufacturers and dealers

June 24, 1924

		Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)	lb.	.05	.05½
Aluminum oxide (Al_2O_3)	lb.	.06½	.07
Antimony oxide (Sb_2O_3)	lb.	.08½	.09
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.08½	.09
Barium carbonate ($BaCO_3$) (precipitated)	ton	68.00	75.00
Barium hydrate ($Ba(OH)_2$)	lb.	.05	.05½
Bone ash	lb.	.06	.07
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.05	.05½
Borax, fused ($Na_2B_4O_7$) any mesh	lb.	.19	.20
Boric acid (B_2O_3), fused	lb.	.35	.35
Cadmium Sulphide (CdS)—			
Red	lb.	..	1.60
Orange	lb.	1.50	1.65
Yellow	lb.	..	1.80
Chrome Oxide (Cr_2O_3)	lb.	.35	.36
Cobalt Oxide (Co_2O_3)—			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide—			
Red (Cu_2O)	lb.	..	.20
Black (CuO)	lb.	..	.25
Black prepared	lb.	..	.30
Cryolite (Na_3AlF_6)	lb.	..	.09⅛
Feldspar—			
100 mesh	ton	14.00-18.00	16.00-22.00
80 mesh	ton	15.00	18.00
40 mesh	ton	12.50	15.50
Ferrous oxide (FeO)	lb.	..	..
Fluorspar (CaF_2)—			
Powdered white, 95%	ton	35.00	..
Hydrofluoric acid (HF) 60% (in lead carboys)	lb.	..	.12
Kaolin (f.o.b. mine)	ton	9.00	12.00
Lead Oxide (Pb_3O_4) (red lead)	lb.	.10½	.10¾
Litharge (PbO)	lb.	.10	.10¼
Lime—			
Hydrated ($Ca(OH)_2$) (in 50 lb. paper sacks)	ton	12.50	..
Burnt (CaO) ground, in bulk	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls. per bbl.		2.15	2.30
Magnesium carbonate ($MgCO_3$)	lb.	..	.08
Manganese 85% (MnO_2)	lb.	.03½	.04½
Nickel oxide (Ni_2O_3), black, for nickel content	lb.	.32	.45
Nickel monoxide (NiO), green, for nickel content	lb.	.30	.50
Potassium carbonate—			
Calcined (K_2CO_3) 96%	lb.	.06	.06½
Hydrated (KOH) 85%	lb.	.05¾	.06
Potassium nitrate (KNO_3) (gran.)	lb.	.06	.06¼
Potassium Permanganate ($KMnO_4$)	lb.	.14	.15
Powdered blue	lb.	..	.24-.30
Standard formula	lb.	..	.32
Salt cake, glassmakers (Na_2SO_4), f.o.b. works	ton	23.00-25.00	30.00
Selenium (Se)	lb.	..	2.20-2.25
Soda ash (Na_2CO_3) dense, 58%— f. o. b. works.			
Bulk, spot	Flat 100 lb.	1.40	..
Bulk, on contract	Flat 100 lb.	1.35	..
In 400 lb. bbls., on contract	100 lb.	1.69	2.40
In 400 lb. bags, on contract	100 lb.	1.45	2.16
Spot orders .05 per 100 lbs. higher.			
Sodium nitrate ($NaNO_3$), refined (Gran.) in bbls	lb.	.04¼	.04½
Sodium selenite (Na_2SeO_3)	lb.	..	2.00
Sodium Fluosilicate (Na_2SiF_6)	lb.	..	.07½
Sulphur (S)—			
Flowers, 155 lb. bbl.	Per 100 lb.	3.35	3.65-3.90
Flowers, in bags	Per 100 lb.	3.00	3.30-3.55
Flour, heavy, in bbls.	Per 100 lb.	2.50	2.80-3.05
Uranium oxide (UO_3), 100 lb lots	lb.	..	1.30
Zinc oxide (ZnO)	lb.	.08	.08¼

Monthly Summary of United States Foreign Commerce in Glass

Exports

Corrected to May 23, 1924

	April 1923 Quantity	April 1923 Value	April 1924 Quantity	April 1924 Value	Ten Months Ending April 1923 Quantity	Ten Months Ending April 1923 Value	Ten Months Ending April 1924 Quantity	Ten Months Ending April 1924 Value
Glass and glass products (total)	.....	1,024,073	.....	716,502	.....	7,878,397	.....	8,262,028
Plate and window glass—								
Window glass, common, box 50 sq. ft.	4,935	28,413	2,274	12,265	27,980	159,995	40,555	182,832
Plate glass, unsilvered, sq. ft.	237,100	102,175	128,592	41,729	1,827,336	720,144	1,338,531	522,344
Other window and plate glass, n.e.s. lbs.	403,858	42,298	237,736	22,179	2,620,450	276,852	2,013,504	221,867
Glass containers (bottles, vials and jars) lbs.	6,625,561	318,342	4,669,947	222,162	47,080,684	2,383,529	53,287,262	2,569,419
Table glassware, plain lbs.	1,918,894	187,178	1,501,621	153,258	15,266,021	1,588,038	15,653,153	1,746,100
Table and other glassware, cut or engraved lbs.	54,110	17,165	39,870	10,689	477,573	182,205	437,631	143,363
Glass for lighting—								
Lamp chimneys and lantern globes lbs.	160,645	32,285	118,301	28,256	1,312,071	257 034	1,644,223	314,250
Globes and shades for lighting fixtures lbs.	107,480	34,340	103,656	32,217	1,278,217	367,217	1,414,005	390,716
Lamps and other illuminating devices, chiefly of glass lbs.	169,533	39,483	85,140	24,630	1,049,355	307,026	1,200,365	311,460
Chemical glassware lbs.	17,753	13,737	23,283	19,161	174,841	120,446	214,568	152,323
Electrical glassware, except for lighting lbs.	250,155	13,401	249,153	23,800	2,546,507	163,680	2,163,022	178,553
Other glassware, n.e.s. lbs.	1,233,186	195,256	542 271	126,156	7,703,435	1,352.231	9,642,033	1,528,801

Imports

Corrected to May 23, 1924

	April 1923 Quantity	April 1923 Value	April 1924 Quantity	April 1924 Value	Ten Months Ending April 1923 Quantity	Ten Months Ending April 1923 Value	Ten Months Ending April 1924 Quantity	Ten Months Ending April 1924 Value
Glass (total)	.....	1,923,830	.....	1,807,929	.....	14,926,162	.....	20,467,531
Cylinder, crown, and sheet lbs.—								
Unpolished, lbs. dut.	5,332,201	217,066	2,389,917	170,737	38,905,290	1,679,701	29,236,359	1,521,516
Bent, ground, beveled, colored, painted, etc. and polished dut.	.....	61,539	.....	55,240	.....	[2]412,709	.....	619,523
Plate glass—								
Unsilvered, sq. ft. dut.	1,946,337	1,228,755	1,609,941	1,012,855	15,074,471	7,837,173	21,004,229	13,464,206
Fluted, rolled, etc., or silvered, or containing wire netting, sq. ft. dut.	129,747	30,747	322,749	39,054	[2]1,186,010	[2]223,684	1,967,276	289,723
Containers—bottles, vials, etc. dut.	.....	13,362	.....	44,080	.....	282,042	.....	148,101
Table and kitchen utensils, lbs. dut.	18,252	4,232	52,177	8,554	[2]490,599	[2]178,657	688,700	145,508
Glassware, cut or decorated, lbs. dut.	304,447	87,328	277,580	135,074	.....	1,364,392	3,077,455	1,374,036
Blown glassware, n. e. s., lbs. dut.	640,283	105,831	.....	.....	[2]3,221,018	[2]701,346	[2]3,402,894	[2]881,319
Bottles, ornaments, etc., lbs. dut.	.....	.....	422,106	152,590	.....	.....	[4]920,091	[4]331,808
Bulbs or electric lamps, lbs. dut.	.....	.....	910,135	15,709	.....	.....	[4]2,424,377	[4]47,182
Chimneys, globes, shades, etc., lbs. dut.	.....	.....	505,054	78,589	.....	.....	[4]1,395,743	[4]222,793
Articles and utensils for chemical, scientific, and experimental purposes, lbs. dut.	.....	.....	63,653	27,029	.....	.....	[4]245,704	[4]98,920
Other glassware { free	.....	.....	.....	.....	[1]44,483	[1]44,253	.....	.....
Other glassware { dut.	.....	174,970	.....	68,418	.....	2,202,205	.....	1,322,896

[1]July to Sept. 21, 1922. [2]Beginning Sept. 22, 1922. [3]July 1 to Dec. 31, 1923. [4]Beginning Jan. 1, 1924.